



**ASSESSMENT OF LOCAL PUBLIC
HEALTH DEPARTMENT CAPACITY
TO ADAPT TO CLIMATE CHANGE
AND BUILD COMMUNITY
PARTNERSHIPS TO PROTECT
PUBLIC HEALTH**

SEPTEMBER 2020



CDC Foundation
Together our impact is greater

THE KRESGE FOUNDATION

ACKNOWLEDGMENTS

This report was made possible by the generous support of The Kresge Foundation and was created through a collaboration between the CDC Foundation, the Centers for Disease Control and Prevention (CDC) and The Kresge Foundation. The CDC Foundation is grateful for this support.

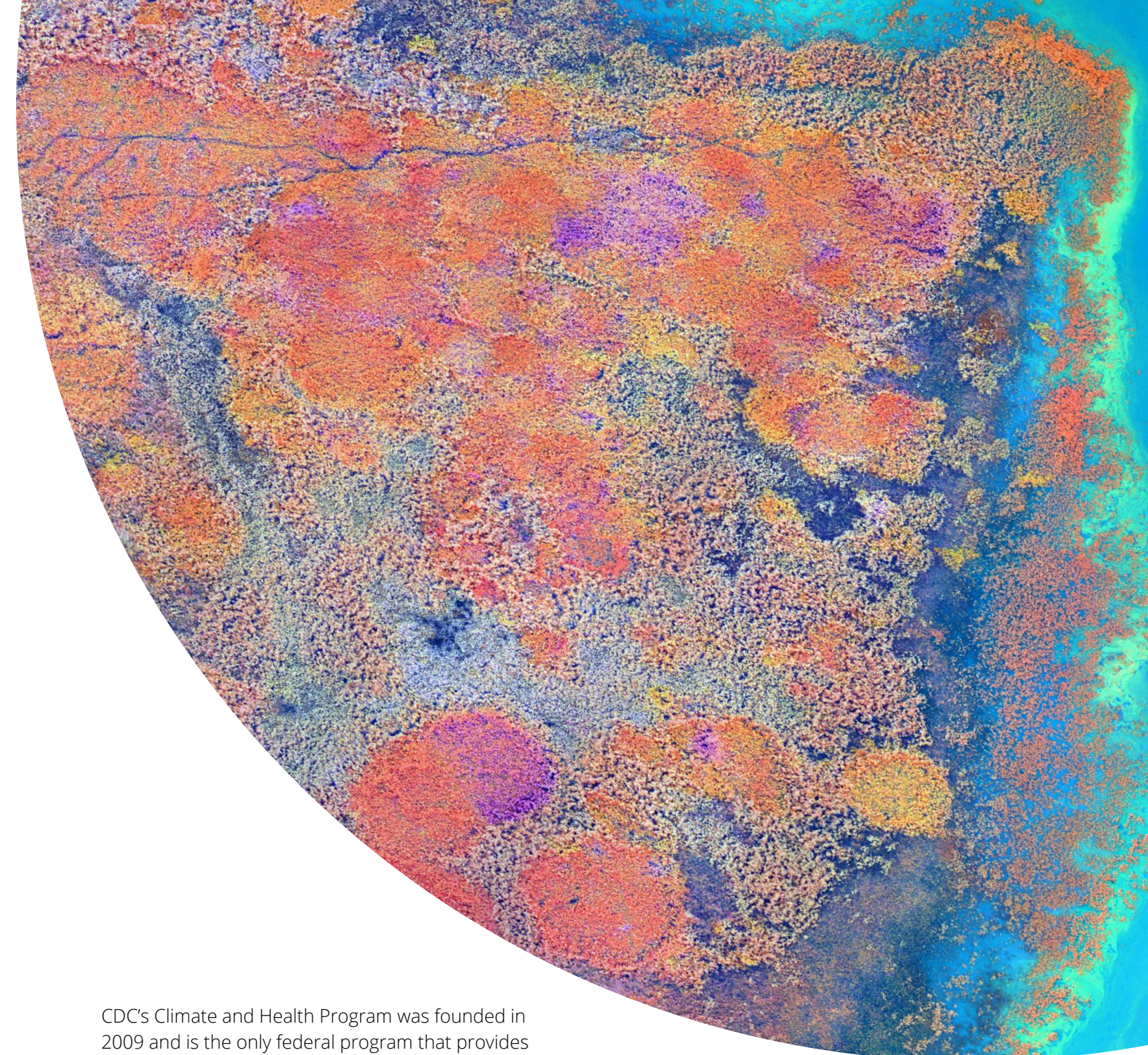
Other organizations who offered expert advice and guidance include American Public Health Association, Atlanta Regional Commission, California Department of Health, Catalyst Miami, Coalition for Environment, Equity & Resilience, Council of State and Territorial Epidemiologists, ecoAmerica, Emerging Leaders in Public Health Program, Go Austin/Vamos Austin, Johns Hopkins University, JPB Foundation, Michigan Department of Health, National Association for the Advancement of Colored People, National Association of County and City Health Officials, National Environmental Health Association, Partnership for Southern Equity, Pew Charitable Trusts, Trust for America's Health and University of Maryland School of Public Health.

The CDC Foundation would also like to thank the following local health departments for their participation: Austin Public Health, Brookline Department of Public Health, City of St. Louis Department of Health, Dekalb County Board of Health, Denver Public Health, Franklin County Public Health, Harris County Public Health, La Crosse County Health Department, Lane County Public Health, Louisville Metro Department of Public Health and Wellness, Minneapolis Health Department, New Orleans Health Department, Oklahoma City-County Health Department, Pima County Health Department, Public Health — Seattle & King County, Rhode Island Department of Health, Salt Lake County Health Department, San Francisco Department of Public

Health, Snohomish Health District, Thomas Jefferson Health District and Washtenaw County Health Department.

The Kresge Foundation was founded in 1924 to promote human progress. Today, The Kresge Foundation fulfills that mission by building and strengthening pathways to opportunity for people with low incomes in America's cities, seeking to dismantle structural and systemic barriers to equality and justice. Using a full array of grant, loan and other investment tools, The Kresge Foundation invests more than \$160 million annually to foster economic and social change. For more information, visit www.kresge.org.

The CDC Foundation helps CDC save and improve lives by unleashing the power of collaboration between CDC, philanthropies, corporations, organizations and individuals to protect the health, safety and security of America and the world. The CDC Foundation is the go-to nonprofit authorized by Congress to mobilize philanthropic partners and private-sector resources to support CDC's critical health protection mission. Since 1995, the CDC Foundation has launched more than 1,000 programs and raised over \$900 million. The CDC Foundation managed hundreds of CDC-led programs in the United States and in more than 140 countries last year. For more information, visit www.cdcfoundation.org.



CDC's Climate and Health Program was founded in 2009 and is the only federal program that provides funding for climate and health adaptation. The Program, located within the National Centers for Environmental Health and the Agency for Toxic Substances and Disease Registry (NCEH/ATSDR), has been supporting state, tribal, local and territorial public health agencies through the development of tools, guidance documents, resources and formal cooperative agreements. These actions help to anticipate and prepare for the health effects of climate change. Funded jurisdictions apply the best

science available to assess vulnerability, project future health impacts and design and implement programs to protect the communities served. For more information, visit www.cdc.gov/climateandhealth.

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of CDC.

A woman with long brown hair, wearing a green and white baseball cap with a butterfly logo, a pink tank top, and blue jeans, is kneeling in a field. She is wearing orange work gloves and appears to be tending to young green plants growing in a grid pattern on a dark, mulched surface. The background shows more of the field with similar plants and a white plastic covering.

***“Climate change is
the biggest environmental
health challenge of our time.”***

– Patrick Breyse, PhD, Director of CDC’s
National Center of Environmental Health
and the Agency for Toxic Substances and
Disease Registry

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	2	RECOMMENDATIONS FOR FUTURE PROGRAMMING	36
TABLE OF CONTENTS	5	How Can Philanthropy or Public-Private Partnerships Help?	37
LIST OF ABBREVIATIONS	6	Estimated Funding Needs	38
EXECUTIVE SUMMARY	8	LIMITATIONS	42
WHY CLIMATE AND HEALTH?	11	APPENDIX A: SUMMARY OF EXISTING EVIDENCE ON HEALTH DEPARTMENT CAPACITY TO ADAPT TO CLIMATE CHANGE	44
WHAT CAN LOCAL HEALTH DEPARTMENTS DO?	14	APPENDIX B: DESCRIPTION OF PROJECT TEAM	46
WHAT DO LOCAL HEALTH DEPARTMENTS NEED TO BETTER ADDRESS CLIMATE CHANGE?	17	APPENDIX C: METHODOLOGY	50
Background	17	Expert Stakeholder Meeting	50
Our Approach	17	Post-Meeting Methods Refinement	53
Results and Discussion	18	Key Informant Interviews Methods	54
Climate Vulnerability	18	Climate Vulnerability Assessment Methods	57
Climate and Health Activities and Capacity	20	Components of Climate Vulnerability Assessment	58
Best Practices	21	Climate Vulnerability Assessment Results	65
Barriers	24	APPENDIX D: STAKEHOLDER MEETING MATERIALS	67
Partnerships Between Local Health Departments and Community-Based Organizations	26	APPENDIX E: RECRUITMENT MATERIALS	74
Strengths of LHD-CBO Partnerships	28	APPENDIX F: DATA COLLECTION INSTRUMENTS	75
Challenges Within LHD-CBO Partnerships	30	Pre-Interview Questionnaire	75
Factors Surrounding the Lack of Partnerships	34	Key Informant Interview Script	75
Impacts of the Partnerships on Climate and Health	34	APPENDIX G: REFERENCES	79

LIST OF ABBREVIATIONS

Abbreviation	Full Form
APHA	American Public Health Association
ATSDR	Agency for Toxic Substances and Disease Registry
BARHII	Bay Area Regional Health Inequities Initiative
BRACE	Building Resilience Against Climate Effects
CalBRACE	California Building Resilience Against Climate Effects
CBO	Community-Based Organization
CCHE	Climate Change, Health & Equity
CCSI	Columbia Center on Sustainable Investment
CDC	Centers for Disease Control and Prevention
CDPH	California Department of Public Health
CRSCI	Climate-Ready States & Cities Initiative
CSTE	Council for State and Territorial Epidemiologists
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
KAP	Knowledge, Attitudes and Practices
KII	Key Informant Interview
LHD	Local Health Department
NAACP	National Association for Advancement of Colored People
NACCHO	National Association of County and City Health Officials
NASA	National Aeronautics and Space Administration
NCEH	National Center for Environmental Health
NEHA	National Environmental Health Association
NIHB	National Indian Health Board
NERHC	Northeast Regional Heat Collaborative
NGO	Nongovernmental Organization

Abbreviation	Full Form
NLDAS	North American Land Data Assimilation System
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
NYC CHP	New York City Climate and Health Program
TFAH	Trust for America's Health
USGCRP	United States Global Change Research Program

EXECUTIVE SUMMARY

The CDC Foundation, with support from The Kresge Foundation and the Centers for Disease Control and Prevention (CDC), assessed 21 urban jurisdictions' capacity to prepare for and address the potential health effects of climate change, including increased heat-related illness, waterborne disease, shifts in vector-borne disease and the physical and mental effects of extreme weather events.

The two main goals of the project were to:

- 1) Assess climate and health capacity and needs (to address health inequities) in a subset of urban communities and local health departments (LHDs)
- 2) Assess the best ways to support and build the capacity of these communities working to prepare and implement strategies to reduce the adverse health effects related to environmental changes within their communities, with a focus on communities and people who are disproportionately at risk

The project team used a mixed-methods approach to conduct these assessments. Using suggestions gathered during an expert stakeholder meeting at the project's start, the project team conducted a survey, key informant interviews (KIIs) and reviewed climate and health data from publicly available sources to characterize the needs and capacities of the 21 jurisdictions. These methods provided information on the state of urban jurisdictions and their health

departments' abilities to respond to the health effects of climate change. Specifically, an overall picture of climate vulnerability, as well as existing best practices, barriers and partnerships needed to implement local adaptation programs were identified.

Of the 21 jurisdictions assessed, 57 percent (n=12) were characterized as experiencing high vulnerability to climate change, with only two jurisdictions experiencing low vulnerability (see Figure 1).

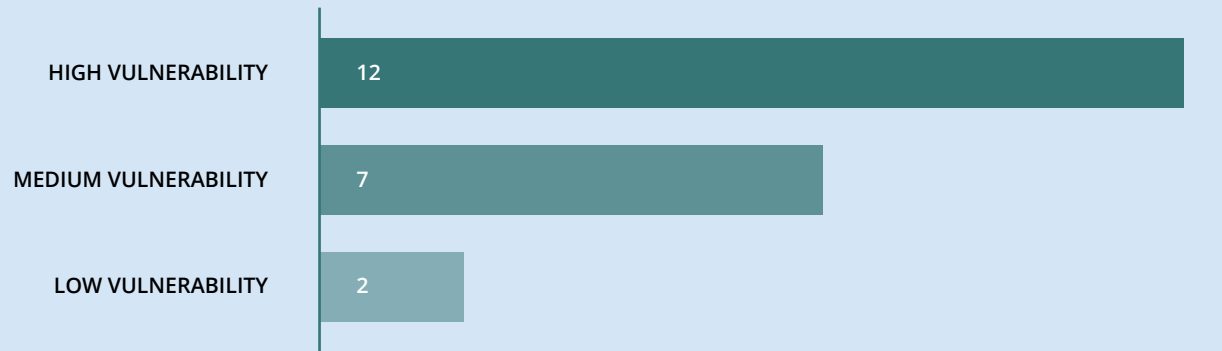
To address the underlying causes and effects of this climate vulnerability, the LHDs described a variety of **best practices** for implementing climate and health programs at the local level.

- **Facilitate climate action committees and partnerships**
- **Approach climate change with a health equity lens**
- **Host local convenings on climate change**
- **Engage local universities for climate change support**
- **Create climate change and health messaging that resonates with local communities**

The LHDs also noted considerable **barriers** to implementing climate and health programs at the local level.

FOR MORE
INFORMATION ON
THE METHODS, SEE
APPENDIX C.

FIGURE 1. CLIMATE VULNERABILITY OF 21 URBAN JURISDICTIONS.



Climate vulnerability scores aggregate scores of three underlying conditions conferring vulnerability: extent to which the jurisdiction experiences localized exposures to climate-related hazards, sensitivity of the community to experience those climate-related hazards and the adaptive capacity of those communities and their health departments to reduce or avoid health effects as a result of climate-related hazards.

- **Inadequate funding for climate change and health activities**
- **Lack of dedicated human resources for climate change and health**
- **Divergent ideologies leading to inconsistent messaging around climate change**
- **Divergent understanding of the role of public health institutions**

The role of **partnerships between LHDs and community-based organizations (CBOs)** was consequently recognized as a key resource for implementing local programs, for several reasons:

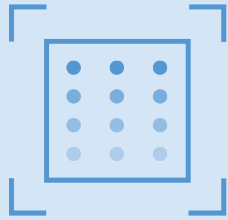
- **CBOs have a cardinal role in engaging with the communities in ways the LHDs cannot, serving as community liaisons**
- **CBOs understand community needs and the resources available in their communities**
- **CBOs can educate the communities in ways that resonate with the communities**
- **CBOs can play an advocacy role for climate change**
- **CBOs are among the first responders to climate hazards**

Existing partnerships between the urban LHDs with CBOs have primarily focused on education, such as helping local communities understand their risks to climate-related hazards, adaptation, such as tree planting or the coordination of cooling centers and mitigation projects, such as recycling initiatives to reduce carbon emissions. The strength of the LHD-CBO partnership varied greatly among the 21 LHDs who identified several challenges in leveraging these relationships:

- **LHDs are not able to adequately support CBOs**
- **Lack of reliability in the partnerships**
- **CBOs and LHDs may have priorities that do not align**
- **Grants applications are time-consuming and have strict requirements**

To better understand why there may be a lack of LHD-CBO partnerships to address the health effects of climate change, the project team conducted a root cause analysis. The results of this analysis are presented in Figure 2.

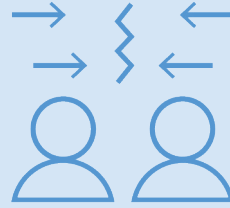
FIGURE 2. ROOT CAUSES UNDERLYING A LACK OF LHD-CBO PARTNERSHIPS ON CLIMATE AND HEALTH.



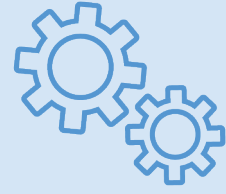
Few CBOs in the climate change space



Some CBOs do not meet federal contractual requirements to allow for partnerships



Different ideologies about climate change



Limited technical capacity for climate change programs

Additionally, 67 percent of participants* of LHDs indicated that there were **no signs of a reduction in climate hazard** as a result of their partnership work with CBOs.

The project team identified the following **recommendations** for future programming to help build the climate and health capacity within urban jurisdictions:

Support Funding Needs:

1. Provide direct funding to county and city level health departments to implement local climate change adaptation, mitigation and resilience activities to protect health, based on population size, local needs and vulnerability.
2. Provide direct funding to CBOs for climate and health work.
3. Fund or support LHDs with dedicated personnel for climate change work.
4. Fund applied research on climate change and health, using community-based, participatory study designs. This would help demonstrate the effectiveness of local actions to protect health.

Support Capacity Building and Partnership Needs:

1. Develop capacity building projects for CBOs on grant applications and management.
2. Encourage LHDs to establish formal agreements with CBOs to outline and fortify their partnerships.
3. Develop training programs for public health professionals on health risks, interventions and

opportunities related to climate change.

4. Engage in projects focused on increasing community cohesion, such as establishing networks and strengthening community members' skills to assist their family and neighbors during emergencies.

Support Research Needs:

1. Conduct localized climate research at the city or community level, perhaps in partnership with universities.
2. Conduct research on the communications models, methods and materials to determine the most effective way to communicate with individuals and communities regarding health-protective behaviors for climate-related health threats.
3. Conduct research on local knowledge, attitudes and practices to better understand the local landscape and uncover what kind of climate and health activities are currently being implemented by partners and stakeholders, and their effectiveness.

*This response is likely impacted by a lack of data. Fifteen of the 21 jurisdictions we interviewed (85 percent) did not develop any metrics to monitor the impacts of their CBO partnerships on climate change.

WHY CLIMATE AND HEALTH?

Climate change is a significant threat to the health of the American people. Climate change affects human health by changing the severity, frequency, duration and location of climate-sensitive hazards such as heat waves, heavy rains, droughts and other severe weather like hurricanes.


Many areas already suffering from the health impacts of weather and climate-related phenomena are predicted to experience worsening health effects such as increased heat-related illness, waterborne disease, shifts in vector-borne disease and the physical and mental effects of extreme weather events. Increasing water temperatures may allow organisms that cause toxic algal blooms or waterborne diseases to thrive in new areas or emerge at new times, posing unexpected health risks. See Figure 3 for Major U.S. national and regional climate trends and Figure 4 for the impacts of climate change on health.¹²

Communities and populations are disproportionately affected by climate change, resulting in health inequities. Risk factors to the health effects of climate change may include age, economic

resources and location. Health departments, especially LHDs, play an important role in preparing communities

for impacts ranging from heat waves to wildfires. However, many health departments do not have adequate capacity, funding, staff and technical support to design and implement climate adaptation programs.





“An unprecedented challenge demands an unprecedented response, and it will take the work of the 7.5 billion people currently alive to ensure that the health of a child born today is not defined by a changing climate.”

– The Lancet Countdown on Health and Climate Change, 2019

FIGURE 3. MAJOR U.S. NATIONAL AND REGIONAL CLIMATE TRENDS. SHADED AREAS ARE THE U.S. REGIONS DEFINED IN THE 2014 NATIONAL CLIMATE ASSESSMENT. FIGURE TAKEN FROM: THE IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH IN THE UNITED STATES (U.S GLOBAL CHANGE RESEARCH PROGRAM, 2016).¹

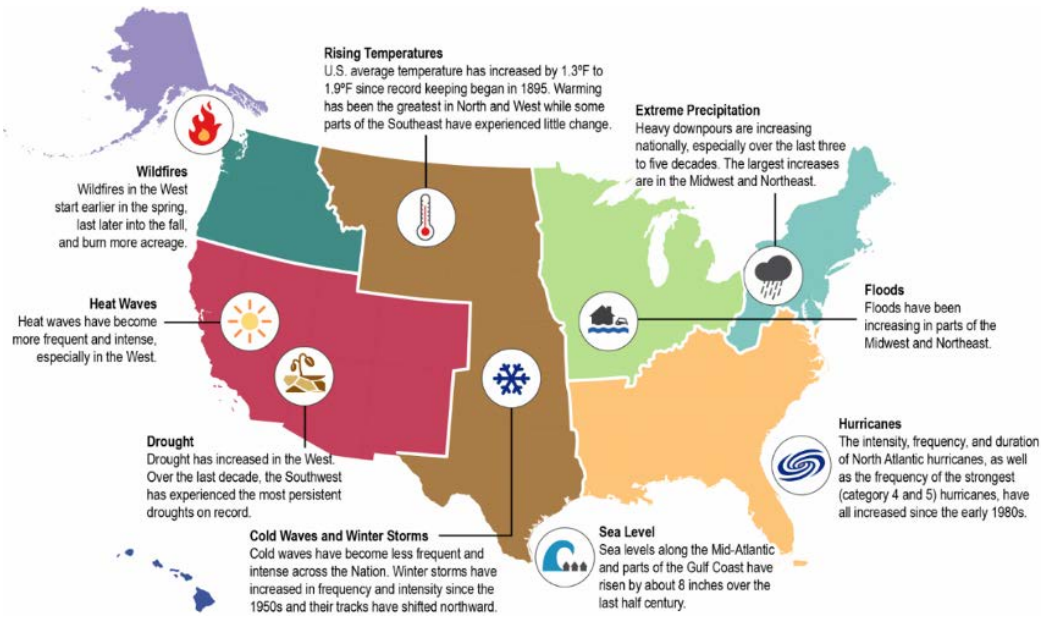
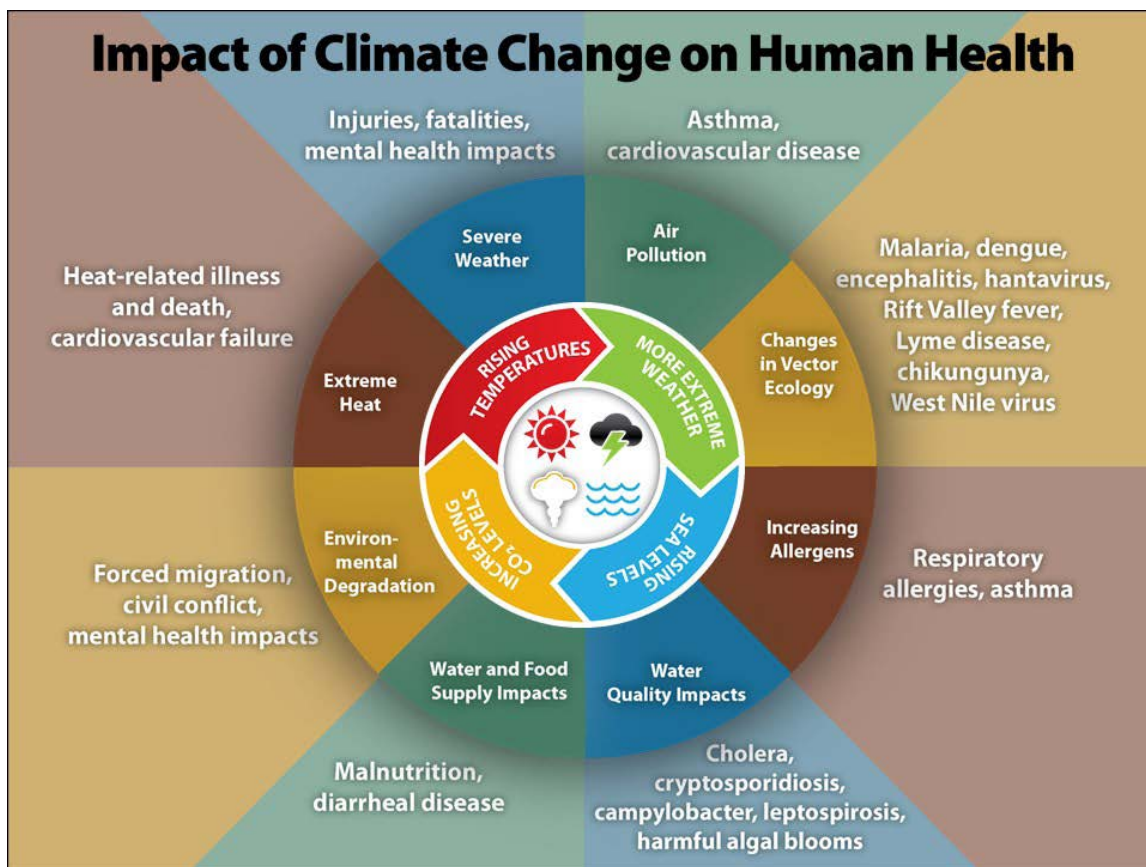


FIGURE 4. CLIMATE CHANGE IMPACTS A WIDE RANGE OF HEALTH OUTCOMES. FIGURE TAKEN FROM: IMPACT OF CLIMATE CHANGE ON HEALTH. (CLIMATE AND HEALTH PROGRAM, CENTERS FOR DISEASE CONTROL AND PREVENTION, 2011).²



WHAT CAN LOCAL HEALTH DEPARTMENTS DO?

Mitigation and adaptation are the primary strategies for combatting the health effects of climate change.

Mitigation involves activities to reduce the source of human-caused climate change, for example by reducing the emissions of greenhouse gases caused by the burning of fossil fuels. In an urban environment, this can occur with public health initiatives aimed at increasing use of walking or biking.

Adaptation involves responding to localized, climate-sensitive hazards that are already occurring or are predicted to occur. Examples of adaptation include opening and maintaining clean air shelters during wild-fires or designing an extreme heat preparedness plan for a jurisdiction prone to heat waves.

MINI CASE STUDIES

Many LHDs across the country have undertaken climate adaptation activities. Below are short case studies highlighting examples from select local jurisdictions. These mini case studies showcase tools, reports, partnerships and plans local jurisdictions are using, or plan to use, to protect their communities from the health impacts of climate change. All of the mini case studies here come from CDC's July 2020 report *Preparing for the Regional Health Impacts of Climate Change*³.



Marquette County Health Department, Michigan

The Marquette County Health Department, located in northern Michigan, worked with stakeholders and community members to develop a [Public Health Response to Flooding Disasters](#) plan to protect their population from increasing extreme rain events. Local decision makers are using the resource to assess climate impacts on their communities' health and using built environment design concepts to incorporate health adaptations into community planning.



New York City Department of Health and Mental Hygiene, New York

The New York City Climate and Health Program (NYC CHP) launched *Be a Buddy*, a two-year pilot program, to foster buddy systems between social service and community organizations, volunteers and at-risk New Yorkers. *Be a Buddy* was deployed during emergencies to conduct telephone and, if necessary, door-to-door and building level checks on at-risk individuals. *Be a Buddy* NYC implemented protective measures against heat-related illnesses by: 1) training community organizations and volunteers on emergency protective measures and ways to assist at-risk adults; 2) engaging communities to identify alternative neighborhood resources for staying cool; and 3)

communicating protective health messages to hard-to-reach populations through trusted messengers. This program cultivated relationships between residents, built routine (for example, staff and volunteers remained consistent in locations and shifts), used face-to-face interactions, phone calls, and social media and communicated emergencies by word-of-mouth through community gatekeepers.⁴

Boston Public Health Commission, Massachusetts



The Boston Public Health Commission developed heat awareness materials and translated them into 10 languages to assist a wide range of communities across the city. These products are designed as communication tools to reach particularly at-risk populations, to reduce health impacts during heat waves.

Clackamas County Public Health, Oregon



Clackamas County Public Health partnered with multiple neighboring counties (Multnomah County Health Department and Washington County Public Health) to form a regional collaborative. They developed a comprehensive climate change and health impact assessment report and an accompanying data visualization tool for the Portland metropolitan region. Stakeholders were engaged to ensure inclusion of local needs.

City of New Orleans Department of Health, Louisiana



New Orleans will develop a heat monitoring pilot program, through which thermometers and heat sensors will be distributed in the community to gather temperature data in partnership with a local community organization. The goal of the pilot program is to develop a better outreach campaign about extreme heat and heat-related illness. The program will focus on improving messaging and health for at-risk populations.

San Mateo County, California



San Mateo County assessed the magnitude and trends of asthma burden and adapted the Community Health Vulnerability Index for their jurisdiction. This allowed the county to address specific local climate and respiratory health issues, especially among at-risk populations.

Northeast Regional Heat Collaborative, New England Region



Northeast Regional Heat Collaborative (NERHC) is a collaboration between Climate-Ready States & Cities Initiative (CRSCI) grant recipients in New Hampshire, Vermont, Maine and Rhode Island. This collaborative measured the impacts of heat on hospitalizations and deaths across New England and partnered with the National Weather Service (NWS) to address heat impacts and improve communications across the region. The group successfully changed the NWS Heat Advisory Policy for New England to more appropriately address health risks and create an opportunity to reduce negative health impacts in communities.⁵

A person wearing a dark winter jacket and hood is riding a bicycle on a snow-covered path. The background shows a brick building with windows and snow-covered trees and bushes. The scene is captured in a cinematic style with soft lighting and falling snow.

LOCATION MATTERS: DIFFERENT CLIMATE IMPACTS ON THE LOCAL LEVEL

While anyone can be affected, not everyone is equally at risk from climate change. The impacts on health due to climate change are both place-specific and path-dependent, meaning the impacts of climate change depend on where you are and who you are, as there are varying degrees of climate exposure and differences in individual and societal characteristics that can either protect you or make you more vulnerable to the impacts of climate change. For example, populations including older adults, children, low-income communities and some communities of color are often disproportionately affected by, and less resilient to, the health impacts of climate change. Adaptation and mitigation policies and programs help individuals and communities prepare for the risks of a changing climate and reduce the number of injuries, illnesses and deaths from climate-related health outcomes.

“Because the health impacts of climate change are extremely localized, engaging local health departments and community-based organizations is vital to creating sustainable solutions.”

– Judith Monroe, MD, president and CEO
of the CDC Foundation

WHAT DO LOCAL HEALTH DEPARTMENTS NEED TO BETTER ADDRESS CLIMATE CHANGE?

“Climate change is a global phenomenon with impacts on people and communities at the local level. Climate change exacerbates local and global health inequities because some people and communities bear an unfair burden of these health harms, including low-income communities, communities of color, native and tribal communities, the very young and very old and those with chronic illnesses.”

– Climate Change, Health & Equity, Public Health Institute ⁶

BACKGROUND

State, local and tribal health departments, as well as their partners in other sectors, play a central role in helping communities prepare for and respond to the health impacts of climate change. Sectors such as agriculture, energy and urban planning are already engaging in community climate adaptation, with a growing recognition of the need to address health effects as part of this work. At the local level, previous yet limited research suggests there is insufficient capacity for climate adaptation, with a strong need for funded projects aimed at protecting health. The findings of this report augment previous evidence and explore whether partnerships between LHDs and CBOs have led to a reduction in the health effects of climate change. The recommendations that follow describe what is already working within these partnerships, and how these partnerships can be strengthened. For a complete summary of previous research, see [Appendix A](#)⁷.

OUR APPROACH

In summer 2019, the CDC Foundation, with support from The Kresge Foundation and CDC, launched a project to assess communities' capacity to prepare for and address the potential health effects of climate

change, including increased heat-related illness, waterborne disease, shifts in vector-borne disease and physical and mental effects of extreme weather events. The project has two main goals:

1. Assess climate and health capacity and needs (to address health inequities) in a subset of urban communities and local health departments
2. Assess the best ways to support and build the capacity of these communities working to prepare and implement strategies to reduce the adverse health effects related to environmental changes within their communities, with a focus on communities and people who are disproportionately at risk

To conduct these assessments, a project team was formed comprised of subject matter experts from The Kresge Foundation, the CDC Foundation and CDC (see [Appendix B](#) for more information on the project team and their roles). Using a stakeholder-driven landscape analysis, the project team collected a mix of quantitative methods and qualitative data: an online survey, KIs and a review of climate and health indicator data from public sources. Data from these sources were triangulated to paint a comprehensive picture of current and future climate vulnerability



in urban jurisdictions, their existing enablers of, and barriers to, adapting to climate change, and insights into how CBO partnerships with LHDs have and can fill programming gaps to address the needs of communities at disproportionate risk to the health effects of climate change. Results below are presented in this order, followed by concrete recommendations.

For complete information on data collection and analysis methods, please see [Appendix C: Methodology](#).

RESULTS AND DISCUSSION

CLIMATE VULNERABILITY

The climate exposure, sensitivity, adaptive capacity and resulting climate vulnerability for each of the 21 jurisdictions is indicated in Table 1. Jurisdiction names are masked to maintain confidentiality, however the jurisdictions identified include cities served by the 21 LHDs interviewed. These 21 jurisdictions are in 19 states across the nation, providing a geographically diverse subset. Scores (0-10 scale) and categorizations (low, medium, high) are shown.

[See Appendix C](#) for a full description of the data and methods used for the [KIs](#) and the [climate vulnerability assessment](#). The project team used an inverse color scheme for the adaptive capacity column, because it is protective. For example, “high” adaptive capacity is protective, whereas “high” climate exposure is harmful.

The project team categorized climate vulnerability into low (less than 6), medium (6 to 8) and high (greater than 8) based on breaks in the data, as described below and in Table 1.

- Low climate vulnerability (score less than 6)
 - 2 jurisdictions
- Medium climate vulnerability (score between 6 and 8) – 7 jurisdictions
- High climate vulnerability (score higher than 8)
 - 12 jurisdictions

These scores are based on an assessment of available data on a select number of indicators which provide a snapshot (not a comprehensive opinion) of these jurisdictions’ exposure, sensitivity and capacity.

TABLE 1. SUMMARY OF ALL THE RESULTS FROM THE CLIMATE VULNERABILITY ASSESSMENT FOR 21 URBAN JURISDICTIONS.

Jurisdictions Assessed	Climate Exposure		Sensitivity		Adaptive Capacity		Climate Vulnerability	
	Score	Level	Score	Level	Score	Level	Score	Level
Jurisdiction 1	5.69	High	4.79	Medium	5	Medium	8.50	High
Jurisdiction 2	4.66	Medium	4.56	Medium	5	Medium	7.81	Medium
Jurisdiction 3	5.46	High	4.34	Medium	2	Low	9.78	High
Jurisdiction 4	5.06	High	4.10	Medium	7	High	6.68	Medium
Jurisdiction 5	6.04	High	6.64	High	5	Medium	9.71	High
Jurisdiction 6	4.29	Medium	3.72	Low	6	High	6.59	Medium
Jurisdiction 7	4.62	Medium	4.70	Medium	7	High	6.77	Medium
Jurisdiction 8	3.58	Low	4.46	Medium	8	High	5.52	Low
Jurisdiction 9	4.50	Medium	4.83	Medium	4	Medium	8.42	High
Jurisdiction 10	3.70	Low	3.45	Low	5	Medium	6.67	Medium
Jurisdiction 11	4.77	Medium	4.03	Medium	3	Low	8.68	High
Jurisdiction 12	4.31	Medium	3.88	Low	9	High	5.05	Low
Jurisdiction 13	4.08	Medium	6.43	High	5	Medium	8.52	High
Jurisdiction 14	5.45	High	4.80	Medium	6	High	7.83	Medium
Jurisdiction 15	4.44	Medium	4.03	Medium	3	Low	8.49	High
Jurisdiction 16	4.55	Medium	5.31	High	5	Medium	8.16	High
Jurisdiction 17	5.43	High	5.78	High	3	Low	10.0	High
Jurisdiction 18	2.54	Low	4.99	Medium	4	Medium	7.43	Medium
Jurisdiction 19	4.09	Medium	4.46	Medium	2	Low	9.09	High
Jurisdiction 20	4.89	Medium	5.15	High	2	Low	9.91	High
Jurisdiction 21	4.30	Medium	3.51	Low	3	Low	8.14	High

CLIMATE AND HEALTH ACTIVITIES AND CAPACITY

When examining the climate and health capacity and needs to address health inequities in this subset of jurisdictions, it is apparent that there are varying levels of capacity. In the interviews, LHDs described their ongoing climate and health activities and highlighted some best practices.

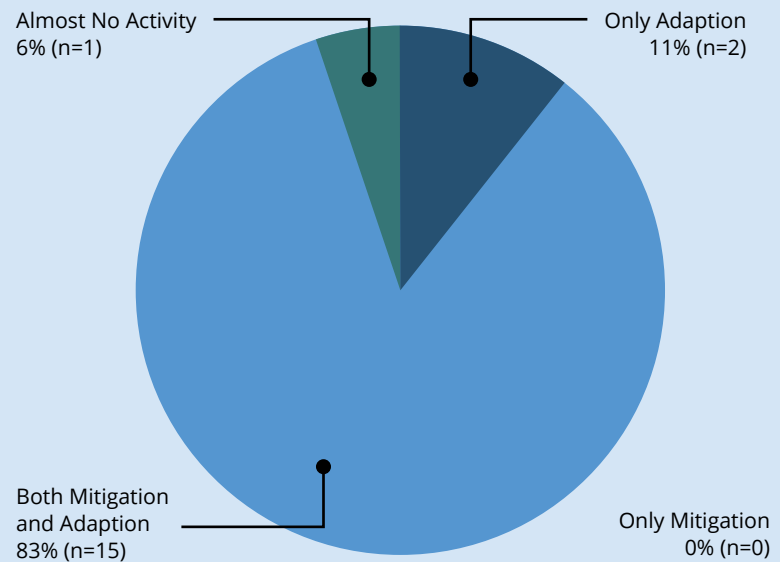
In the pre-interview questionnaire, the LHDs indicated the kinds of climate and health activities that were taking place in their jurisdictions. Figure 5 shows the distribution of different climate change efforts. The majority (83 percent, n=15) of the LHDs had both mitigation and adaptation programs, 11 percent (n=2) were only engaged in adaptation efforts, and 6 percent (n=1) reported almost no activity for either.

In the KIIs, LHDs stated they were aware of the health impact climate change is having in their jurisdictions, however, the activities to respond to these health threats vary in depth and scope. Seven of the LHDs (n=7) are in the early stages of developing their climate and health activities. Fourteen LHDs (n=14) have developed or are developing climate action plans or climate vulnerability assessments and others address the health impacts of climate change through the LHD's emergency preparedness programs. One key informant narrated:

"The health department itself does not have any definitive [climate change] program. I do emergency preparedness. And as part of my planning, I look at ways to mitigate the effects of natural disasters or other climate-related events that could cause injury or illness to the community... More work is being done quietly, not necessarily saying it's a climate change program, but it's something we're trying to do with no funding to go with it. We don't necessarily call it climate

FIGURE 5. PRE-INTERVIEW QUESTIONNAIRE DATA ON CATEGORIES OF CLIMATE AND HEALTH EFFORT.

How would you characterize the climate and health efforts that are currently taking place within your jurisdiction? (n=18)



change, I do on my plan, but when we're trying to do these community efforts for underserved populations we're looking at things we can do that aren't monetarily big, but still have some effects people."
– Jurisdiction 21, High Climate Vulnerability

Adaptation projects described in the interviews included infrastructural adjustments such as installing cooling equipment, designing and building structures able to withstand flooding and tornadoes and building emergency shelters such as resilience hubs. Participants also stated educating community members on the different local climate hazards and how they can protect themselves (economically, physically and psychologically) as an adaptation practice. A key informant narrated some of the activities around their education and outreach:

"...this [community] is particularly vulnerable to flooding. So, training community members to talk to other community members about what to do about in case they're vulnerable to flooding, how

to get insurance if you're flooded, how to talk to insurance, what to do, how to be prepared. And we're also organizing with Homeland Security Emergency Management [to inform] people about where to go in cases of flood and for us to know where they would naturally go in case of floods so that we are prepared to meet them there...this is only a couple of years old. So, we're starting with those, with the thought that in the future, we would expand this program to include more things."

– Jurisdiction 14, Medium Climate Vulnerability

Mitigation projects within the LHDs were mainly aimed at reducing the jurisdictions' carbon footprint. Activities described in the interviews included promoting green infrastructure, de-incentivizing polluting infrastructure, reducing greenhouse emissions, implementing city-level policies that encourage renewable energy use, implementing city-level policies that discourage or ban plastic use and tree planting. To lead by example, one city health department is currently running their entire office building on solar energy. Another jurisdiction created a city-level carbon tax. A key informant described the tax in their city:

"We're talking about small generators of pollution, like dry cleaners and autobody shops. We're really bringing down the pollution. We're also using those dollars to increase energy efficiency, so decreasing the carbon footprint of the city. We're helping mosques and churches and nonprofits put in solar energy panels, change their light bulbs to better efficiency light bulbs."

– Jurisdiction 8, Low Climate Vulnerability

BEST PRACTICES

Several best practices for implementing climate and health programs at the local level emerged from the 21 KIs. The five most prominent themes are:

1. Having climate action committees and partnerships
2. Approaching climate change with a health equity lens
3. Hosting local convenings on climate change
4. Engaging local universities for climate change support

5. Creating climate change and health messaging that resonates with local communities

1. Having climate action committees and partnerships

Well-coordinated climate action groups are important for advancing the climate change agenda and facilitating cross-learning. These groups could encompass different stakeholders from government and nonprofit organizations. Twelve LHDs (n=12) involved in advanced climate change work reported having well-organized and fully functional climate action groups that are responsible for overseeing and managing climate change activities within their jurisdictions. A key informant from the LHDs explained:

"Well, we've been involved with climate activities for quite a few years here. We were one of the first, local health departments to really get engaged on the topic and to partner with elements of our community. We have helped to form some collaborative organizations, one of which is the [State] Climate Action Network. We were one of five organizations locally here that initiated the development of that group. And it is sort of an umbrella organization to coordinate and foster collaboration among local groups and organizations in all sectors that deal with climate-related issues. And we have a rather large structure that has been developed out of that group. And in the public health arena we have been working for a couple of years now with 4 standing committees that are under that umbrella. One is the Climate Work Group, which is focused on health, health outcomes, health impacts of the changing climate here."

– Jurisdiction 7, Medium Climate Vulnerability

One LHD (n=1) reported having a multisectoral "climate leadership team" that is made up of department heads and leads, such as the directors from the department of natural resources, the director of transportation and local public health leaders. The team convenes at least monthly to discuss climate change issues and then provides recommendations to city executives. Similarly, two other LHDs (n=2) reported having groups that focus

on climate change, which were called “environmental councils” or “climate health action teams.” LHDs stated that these committees have helped advance climate and health work. Some examples provided were plans to achieve net-zero emission by 2035 and plans to address food insecurities.

2. Approaching climate change with a health equity lens

All the LHDs interviewed (n=21) reported taking an equity approach in either their climate change programs (n= 16) or more broadly in other health programs (n=5). LHDs indicated that they are focusing on underserved communities such as the elderly, the poor and communities of color. The LHDs interviewed identified equity as an important consideration because climate change can disproportionately impact vulnerable populations. Furthermore, because of historical neglect by LHDs, these underserved communities may be reluctant to trust that the LHD is acting on behalf of their best interests. The hope, as identified by the interviews, is that addressing the health inequities to climate change (and more broadly) will reduce the health burden on communities who are already disproportionately at risk and build community trust in the LHD. A key informant addressed this issue by saying:

“I think climate change too often gets seen as a separate issue or something that is seen apart from other issues, and I think the things we need to do to address climate change are so broad reaching and so fundamental. From our perspective approaching it, from our work on health equity, we’re embedding climate change action into all of the broader goals we have around, around housing, around economic and racial justice around redesign in order to address the barriers people have with inequities and building healthy and resilient communities overall. So, we very much see that as being done at the community level and being supported through various agencies and, and, and mechanisms. So, our collaborations with our [CBO name redacted] and other community-based partners are really where that change originates from.”
– Jurisdiction 13, High Climate Vulnerability

Fourteen LHDs (n=14) acknowledged that local climate vulnerability assessments can be used as a tool to identify and address health inequity in a community. Vulnerability assessments help LHDs identify which groups are most at risk and can be used to equitably provide resources and aid. LHDs reported that vulnerability assessments were most successful and comprehensive when community and city officials were also engaged in the process. The LHDs interviewed understand that some communities are more vulnerable to the health impacts of climate change and therefore, approaching climate change with a health equity lens is cardinal. Some LHDs with climate and health programs have incorporated health equity in every activity of the program. A key informant narrated:

“Every single strategy has an equity component to it. And every single goal has an equity component. So that we did this by engaging, I think about a hundred or 200 people. And we’re trying to get a majority of those folks who actually lead the effort, provide, um, strategies and goals to be a person of color or, or increased diversity. So that each action is designed to not only reduce greenhouse gas emissions, but right the wrong of the past.”
– Jurisdiction 14, Medium Climate Vulnerability

Implementing climate change programs with an equity focus is important in addressing the needs of underserved communities and helps address the social determinants of health. LHDs used vulnerability assessments and community consultation to implement their climate change programs more equitably.

3. Hosting local convenings on climate change

Local conferences and convenings serve as platforms for information sharing and raise awareness and urgency for climate action. Celebrations of climate change-related dates, such as Earth Day and World Environment Day, could serve as a reminder that actions need to be taken to address the health impacts of climate change. One strategy to ensure future community leaders are aware of the urgency of climate issues and equipped to solve them is

to involve youth in climate change work. Two key informants expressed:

“The health department has hosted for eight years now an annual event, we call [it] our Climate & Health Symposium where we bring in outside speakers [and] experts in the field of climate science and health impacts...We also have hosted an Earth Day event out of the facility here in environmental health and the health department on or right near earth day every year where we will partner with elementary schools to bring classes here to our facility where we highlight issues of sustainability and the environment in collaboration with local partners, mostly nonprofits.”
– Jurisdiction 7, Medium Climate Vulnerability

“We have a symposium on the weekends that is just focused on climate action and kids... So, one of the first things we did was we put climate action programs in the school system to teach the kids. So now we have teenagers that are out protesting about climate change.”
– Jurisdiction 12, Low Climate Vulnerability

LHDs convened conferences with local communities and featured experts sharing information about climate change. These conferences are important because they raise awareness and educate the public about climate change.

4. Engaging local universities for climate change support

Nine LHDs (n=9) have engaged universities to provide subject matter expertise and other support for the LHD climate change initiatives. LHDs engaging universities is advantageous because universities can provide the much-needed evidence-based data to support decision making within LHDs. Universities often can conduct research in ways that some LHDs do not have the capacity to do. One key informant stated that their partnership with the university “drives a lot of the work here [at the LHD],” and another key informant shared:

“...another primary facilitator is the University. Over the last year and a half, they have made huge investments

in their academic staff and actually created the [name redacted] Environment Institute that studies how the environment affects your health and how you can address health outcomes through adjusting and improving your environment. Even to the point where they’re studying the causes of diabetes being associated with air pollution.”

– Jurisdiction 4, Medium Climate Vulnerability

It is good practice to engage with academic experts and form partnerships with local universities because universities have a unique ability to provide community context and evidence-based examples of the implementation of climate and health activities on a local scale.

5. Creating climate change and health messaging that resonates with local communities

Messaging affects how communities respond to climate change. Many LHDs have recognized a need for climate change and health messaging that is



concordant with their communities. A key informant gave an example of tailored messaging initiatives within a local community, stating:

"...She worked with some community groups about a year or two to put together some really great educational information around heat and how to take care of yourself during the heat and she worked with groups to help translate it and to make sure that the stories and the materials, kind of like comic book type of thing,... resonated with different communities in [another] language."

–Jurisdiction 7, Medium Climate Vulnerability

Creating consistent, tailored messaging materials that resonate with different communities is good practice for climate change and health programming.

BARRIERS

LHDs face numerous barriers when preparing and implementing strategies that reduce health impacts related to climate change. These include systemic barriers as well as more localized barriers. Based on the KIs, the four most prominent barriers for implementing climate and health programs at the local level are:

1. Inadequate funding for climate change and health activities
2. Lack of dedicated human resources for climate change and health
3. Divergent ideologies leading to inconsistent messaging around climate change
4. Belief that climate change is not a core responsibility of public health institutions

1. Inadequate funding for climate change and health activities

Like many other public institutions, the LHDs reported funding challenges for climate change and health programs. LHDs indicated that they have been historically underfunded (or unfunded) because the health impacts of climate change are viewed as new issues for health departments to take on. Some LHDs reported that they were not aware of any

funding sources identified for climate change. A key informant mentioned:

"In terms of our department, we don't have a lot of specific activities around climate change. Not that we lack interest, but there aren't funding sources that are specifically identified for that... that we know of anyway, that are available to us. So, we're interested, but there's not a lot happening, specifically within this department primarily because we're not aware of a funding source."

– Jurisdiction 19, High Climate Vulnerability

Three LHDs (n=3) indicated that the federal funding structures often create funding streams which are siloed and inflexible, making it difficult to create tailored, localized climate and health programs. A key informant noted:

"And so, there is, there is extremely little flexibility within the common funding sources, for at least public health departments in my area. So, lack of funding and inflexibility to funding sources."

– Jurisdiction 19, High Climate Vulnerability

The lack of funding for climate change is worsened by the competing needs the LHDs must address. Some needs seem more urgent while climate change is often perceived as a distant issue. There is a need to change this misperception because climate change is actively occurring and warrants dedicated funding.

2. Lack of dedicated human resources for climate change and health

The lack of human resources at LHDs that are dedicated to climate and health programs is another common and systemic barrier. At most, the LHDs interviewed had one staff dedicated to climate change work, and the LHDs expressed that having one position was insufficient and often overwhelming because the amount of work needed to be done. Eleven LHDs (n=11) had no dedicated staff for climate and health and reported often asking their staff to take this work on voluntarily in addition to regular duties. This can result in staff working on climate



and health activities without the needed technical capacity nor the time to complete or plan appropriate activities. When asked if LHDs had dedicated staff for climate change, a key informant responded:

“There hasn’t been a lot of focus on climate change until like the last few years. And it’s only if somebody has the bandwidth in their program or time that they can actually add that little extra work onto it because it’s really not enough resource, human and or financial resources to do anything with climate change.”
– Jurisdiction 21, High Climate Vulnerability

LHDs have many competing needs and often must respond to emergent issues. For this reason, climate and health programs are often not prioritized because LHDs lack dedicated human resources. Dedicated positions for climate and health need to be established in LHDs. The LHDs interviewed reported there was interest and willingness by staff to work on climate and health programs, but the LHDs needed additional resources to be able to do so.

3. Divergent ideologies leading to inconsistent messaging around climate change

Differing views about the validity of climate change impact LHDs ability to work and speak about climate change and health activities. The differing views on climate change have led to inconsistent messaging and many LHDs suggested that climate change is often politicized. One participant demonstrated the difficulties this can cause by saying:

“[There is] Misinformation from the national level. So, when the community receives different information from the national level and the local level and the state level, that creates one, distrust, and people just don’t take it seriously or people just ignore it altogether.”
– Jurisdiction 9, High Climate Vulnerability

In some areas, climate and health work is not prioritized because members of a jurisdiction view

it as unimportant. One LHD (n=1) further expressed concerns about the rigidity of such views even with the available data and science.

Messaging for climate change is an important aspect that could affect its programing. Therefore, there is a need to emphasize the use of evidence-based messaging at the national and community level while staying apolitical. This can help break some of the information inconsistencies.

4. Belief that climate change is not a core responsibility of public health institutions

Health departments operate on the fundamentals of public health services. However, there are different views among the LHDs on their role in addressing the health impacts of climate change. Four LHDs (n=4) viewed climate change as being outside the mandate of their LHDs, or a low priority, and thus they did not have any climate and health activities. Two key informants explained:

“We’re focused in on the basic foundations of public health and climate change is outside of that foundational box...when we’re prioritizing things, climate and health is not up high on the list. It’s down lower.”
– Jurisdiction 16, High Climate Vulnerability

“The health departments operate in crisis mode most of the time. And so, we’re generally putting out fires and, you know, climate change is one of those things like, “Oh yeah, when all ... When all these other things calm down, I’ll get to that climate change. And then something else pops up and you’re back where you started.”
– Jurisdiction 3, High Climate Vulnerability

PARTNERSHIPS BETWEEN LOCAL HEALTH DEPARTMENTS AND COMMUNITY-BASED ORGANIZATIONS

In the pre-interview questionnaire, the project team asked the LHDs if they have existing partnerships with CBOs. Figure 6 shows that 61 percent (n= 11) of the

LHDs interviewed have some form of partnerships with CBOs while 39 percent (n= 7) do not have any partnerships with CBOs.

Even though not all the LHDs have partnerships with CBOs, the interview data indicated that all the key informants (n= 21) recognized the importance of partnering with CBOs. Specifically, the key informants recognized that:

- CBOs have a cardinal role in engaging with the communities in ways the LHDs cannot
- CBOs are community liaisons
- CBOs understand community needs and the resources available in their communities
- CBOs can educate the communities in ways that resonates with the communities
- CBOs can play an advocacy role for climate change
- CBOs are among the first responders to climate hazards

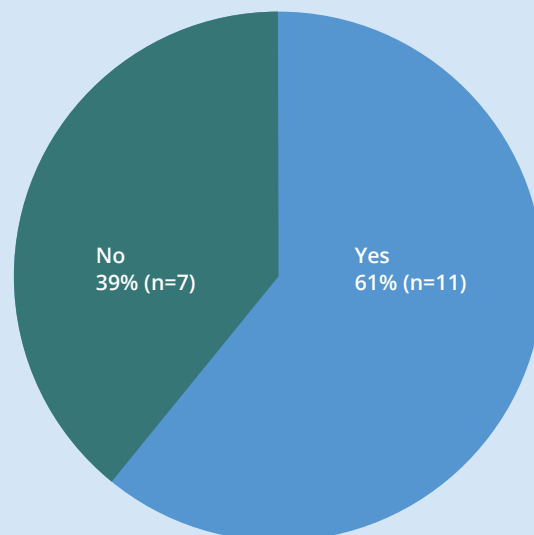
A key informant describing the importance of CBOs said:

“I would describe it as we wouldn’t be able to accomplish what we do if we did not have partnerships. So, it is essential. Number one, it’s a win, win situation. The health department cannot stand alone in any community without CBO collaboration. You need that private-public-governmental partnership to accomplish anything. It cannot solely be [run] by the government, it needs to be owned by the people. It needs to be owned by community groups. The people and government may change, but the people that live in the community will remain the same.”
– Jurisdiction 12, Low Climate Vulnerability

The LHDs have partnered with CBOs primarily on education and outreach programs, as well as other adaptation and mitigation projects. The education and outreach programs described include education on the causes and effects of climate change and emergency preparedness for climate hazards. Adaptation projects created by partnerships between LHDs and CBOs include creating cooling centers, developing flood protective infrastructure and educating the community on effective climate hazard responses. Mitigation projects included tree planting, recycling initiatives and programs to reduce the jurisdiction’s carbon footprint. Many strengths were highlighted in LHD-CBO partnerships, some of which included willingness and passion among CBOs to work on climate change and long-standing trust between LHDs and CBOs. In the pre-interview questionnaire, the project team asked participants to rate their partnerships with CBOs on a Likert scale of 1 to 5, with 5 being the strongest partnerships and 1 being the weakest partnerships. Figure 7 shows an equal distribution between aggregated weak and strong partnerships scores.

FIGURE 6. PRE-INTERVIEW QUESTIONNAIRE DATA ON PARTNERSHIPS BETWEEN LHDS AND CBOs.

Does your LHD currently partner with any CBOs for climate work? (n=18)



STRENGTHS OF LHD-CBO PARTNERSHIPS

All the LHDs (n=21) highlighted the strengths of engaging in partnership with CBOs and the positive aspects CBOs bring to the partnerships. Below are some of the strengths of LHD-CBO partnerships identified in the KIIs, which are described in more detail in the following section:

1. Willingness and passion among some CBOs to work on climate change with LHDs
2. Strong trust between the CBOs and LHDs
3. CBOs recognize the health impacts of climate change as a problem
4. CBOs serve as community liaisons in the LHD-CBO partnerships
5. CBOs play an advocacy role

1. Willingness and passion among some CBOs to work on climate change with LHDs

LHDs reported that CBOs, when engaged, are open to ideas, involved and are enthusiastic to do climate and health work. Participants did report that while partnerships can be slow to progress, CBOs are often very passionate about partnering with LHDs to work on climate change. A key informant emphasized:

"I think that [the partnerships are] going very well. I

think that [the partnership is] probably moving slower than we all would like, because it takes a lot of planning and figuring things out. But we are laying some really, really good groundwork...Everybody [CBO & LHD] seems very passionate. I mean, once you start working with CBOs and the people in this field, everybody is very passionate..."

– Jurisdiction 2, Medium Climate Vulnerability

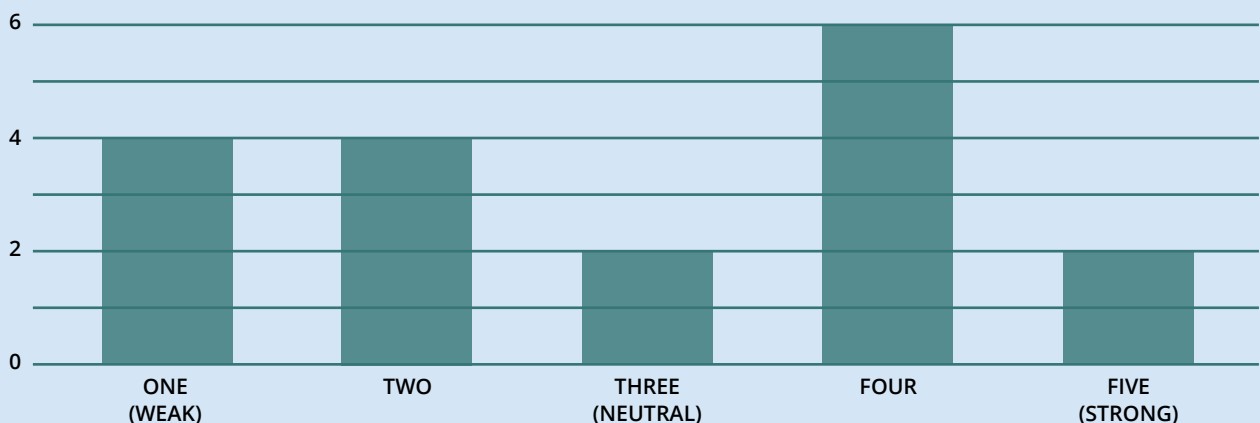
LHDs should consider leveraging the willingness of CBOs to work on climate and health, particularly to counteract the issue of understaffed LHDs.

2. Strong trust between the CBOs and LHDs

Trust is fundamental in any partnership. Trust is particularly important in LHD-CBO partnerships because much of the work is done informally or with verbal agreements. A key informant stated that they *"collaborate at the speed of trust."* Another called their agreements in LHD-CBO partnerships *"handshake agreements."* Seven LHDs (n=7) reported that they had built trust over the years of working together with CBOs. Much of the informal work conducted in LHD-CBO partnerships is for under-funded or unfunded activities. This further substantiates the willingness and dedication that the CBOs have exhibited in their climate change partnerships with LHDs.

FIGURE 7. PRE-INTERVIEW QUESTIONNAIRE DATA ON STRENGTH OF PARTNERSHIPS BETWEEN CBOs AND LHDs.

On a scale of 1 to 5, overall, how would you rate the strength of your CBO partnerships? (n=18)



3. CBOs recognize the health impacts of climate change as a problem

All LHDs who partner with CBOs stated that CBOs recognize the health impacts of climate change as a major problem that needs to be addressed. CBOs operate at the community level and often see the negative impacts of climate change firsthand. For this reason, CBOs are motivated and willing to participate in and advance the climate and health activities in a jurisdiction.

4. CBOs serve as community liaisons in the LHD-CBO partnerships

Because CBOs operate at a community level and are aware of events and activities in a community, they can provide vital information to LHDs around the needs and wants of the communities. Two key informants confirmed:

“So, the more we work with community-based organizations the better access we have to data and the people we can learn from who might be impacted by those [climate change] stressors.”

– Jurisdiction 14, Medium Climate Vulnerability

“CBOs have a deep connection of community members in those areas most impacted by climate change.”

– Jurisdiction 14, Medium Climate Vulnerability

LHDs reported that CBOs can work with and engage communities in ways the LHDs cannot. LHDs indicated that LHD staff are often technically focused and may not have the background needed to communicate effectively with the community. CBOs can help LHDs create connections through messaging and outreach. A key informant narrated the following:

“...Community-based organizations...come at it from a different perspective. Sometimes they can do what government cannot do, what government is limited in doing. Sometimes they can get past some of the political impediments

that are out there. And then finally...they really represent community voice...I do think there's an incredibly important role that these groups play.”

–Jurisdiction 5, High Climate Vulnerability

CBOs have leveraged their position in the communities to provide education and outreach services in climate change and health activities. All LHDs (n=21) acknowledged CBOs shared information with their communities in a way that resonates with them. A key informant attested:

“...CBOs can do all of that [information sharing] and magnify it so much better. They can get the into our communities who often are not at the table and don't have a voice. They can reframe the conversation in a way that magnifies and expands it, right? 'Cause the drivers for climate and health are so different from



community to community. And so, CBOs are critical in, in keeping that conversation going, sharing it, spreading it and creating it in a way that is meaningful to their community. And however that community is defined, whether it's by religious preferences, whether it's by race, language, group, neighborhoods, whatever."

– Jurisdiction 16, High Climate Vulnerability

CBOs are deeply rooted in the community. They provide important contextual information to LHDs and can disseminate information to the communities on the health impacts of climate change in a way that resonates.

5. CBOs play an advocacy role

The LHDs interviewed indicated that CBOs have played a key role in advocating for the need for climate and health work. Often LHDs are not able to advocate for climate change and thus greatly benefit from partnering with CBOs. Three participants stated:

"they [CBOs] can hold other organizations, governmental organizations to their commitments in a different way than I can, from inside the system." – Jurisdiction 16, High Climate Vulnerability

"that's the best situation because it externalizes the demand for us, which is good." – Jurisdiction 14, Medium Climate Vulnerability

"They [CBOs] are the highest, um, the highest of importance in climate change work. It is essential, um, because it's a citizen-led town. If anything happens in climate change, they think we need funding or personnel. It is those committees that do advocacy work to our finance committee in the town to say, we want this to happen or not. That's how we got the sustainability position. It was through the various community organizations that did advocacy work, that were activists for this that actually showed up at meetings, with signs saying we need this position." – Jurisdiction 12, Low Climate Vulnerability

CHALLENGES WITHIN LHD-CBO PARTNERSHIPS

The interviews with LHDs also highlighted weaknesses



in the climate and health partnerships between CBOs and LHDs. Some of the weaknesses included unreasonable expectations in the partnership, lack of accountability, lack of partnerships altogether and lack of CBOs' capacity to meet partner requirements. The following are challenges LHDs identified, which are described in more detail in the following section:

1. LHDs are not able to adequately support CBOs
2. Lack of reliability in the partnerships
3. CBOs and LHDs may have priorities that do not align
4. Grants applications are time-consuming and have strict requirements

1. LHDs are not able to adequately support CBOs

LHDs are sometimes unable to fund climate change and health activities within their partnerships due to competing needs, bureaucratic processes and limited funds. Six LHDs (n=6) reported they expect a lot from the CBOs even when they do not fund them. A key informant attested:

"The biggest challenge is that we ask too much of our CBOs and we don't fund them enough. If we wanted to do it right, we would pay them to have staff to help us

with our programs. So, we would pay the community organizers to actually help us do this work rather than assume that they'll do it for free. And they have very little capacity 'cause they're a very little funding."
 – Jurisdiction 14, Medium Climate Vulnerability

Some LHDs reported that CBOs are overburdened by requests from LHDs, while CBOs have pressing needs of their own. A key informant indicated the following:

"They [LHDs] also realize that many of the communities that they're working with have a lot of things that they're concerned about and climate is only one of those things. And so, they're helping...but then when people are just trying to have a safe place to live and putting food on the table and getting their kids educated, um, climate may not seem like a high priority to them."
 – Jurisdiction 6, Medium Climate Vulnerability

Despite understanding the need to fund CBOs, LHDs are often unable to do so. A key informant critiqued:

"Part of it is ingrained bureaucracy. We've been doing the same thing for a long, long time and I've not really figured out how to change quickly. Also, our funding structures are really based on what we've always done... The budget is based on last year's money that we spent before. We determined where stuff should go without any community input and then we just put it into the system and then five years later we have a new road here or a new bridge there, or a new culvert there. And it doesn't allow for community members to understand how the system works and provide feedback on where things should go...it's hard for us to actually give money to a CBO."
 – Jurisdiction 14, Medium Climate Vulnerability

Sometimes, even when funds are available, they cannot be directed for CBO support. Some LHDs acknowledged that they are slow to respond to the CBOs' requests. A key informant indicated:

"I mean, I think the hard part is that we have money at the city. We just don't direct them towards CBOs, one. Two is that we can engage with CBOs, but we're

not very quick to respond. So if the community needs something, it might take us like five years to turn around and get it to them."

– Jurisdiction 14, Medium Climate Vulnerability

LHD-CBO partnerships have been challenged with limited funding and systemic bureaucracies. This situation is made worse by the competing needs both LHDs and CBOs face. CBOs are often expected to work without funding, which can present challenges in the partnerships.

2. Lack of reliability in the partnerships

LHDs reported a lack of reliability within their partnerships with CBOs due to funding challenges and competing needs. It is difficult for CBOs to complete climate and health projects without the required funding and thus CBOs are more likely to devote time to other, well-funded projects. One key informant indicated:

"Definitely accountability is an area that we tend to struggle with, with our CBOs and ourselves. And I think I touched on earlier, everybody's kind of doing multiple projects at once, and sometimes the climate change work tends to feel like an ad hoc one. So, things don't necessarily get done when we say they're going to get done even just like emails or surveys, that kind of thing."
 – Jurisdiction 2, Medium Climate Vulnerability

Informal work agreements between CBOs and LHDs may work well for some partnerships but not all, particularly when there are insufficient funds to support activities. Participants also reported mistrust can exist because both CBOs and LHDs do not follow through on what they committed themselves to.

3. CBOs and LHDs may have priorities that do not align

Five LHDs (n=5) expressed that CBOs have their own priorities and responsibilities which, when unaligned with the LHD's priorities creates challenges in their partnerships. One challenge that emerged from the interviews is related to differing views and opinions about climate change. These differences have created

problems when conducting education and outreach services due to different messaging. A key informant shared the following experience:

"I think that there are some community groups that might have different opinions about what needs to be done in terms of climate change...when we partnered with the [CBO] for law and policy, they were helping teach some classes for us. We had some difficulty figuring out what could be said on behalf of city governments. And just looking at the political aspects,

there's also a few community groups that do a wide variety of things, some of which is climate change. And so, we don't always align on all of those views...you need to find some boundaries with community groups or, find the right people to partner with."
 – Jurisdiction 1, High Climate Vulnerability

There are some influential members within the community groups that often drive the conversations, and this may be mistaken to be the entire group's view. This is a problem because it creates a situation where the CBOs' views are not reflective of community views. A key informant narrated:

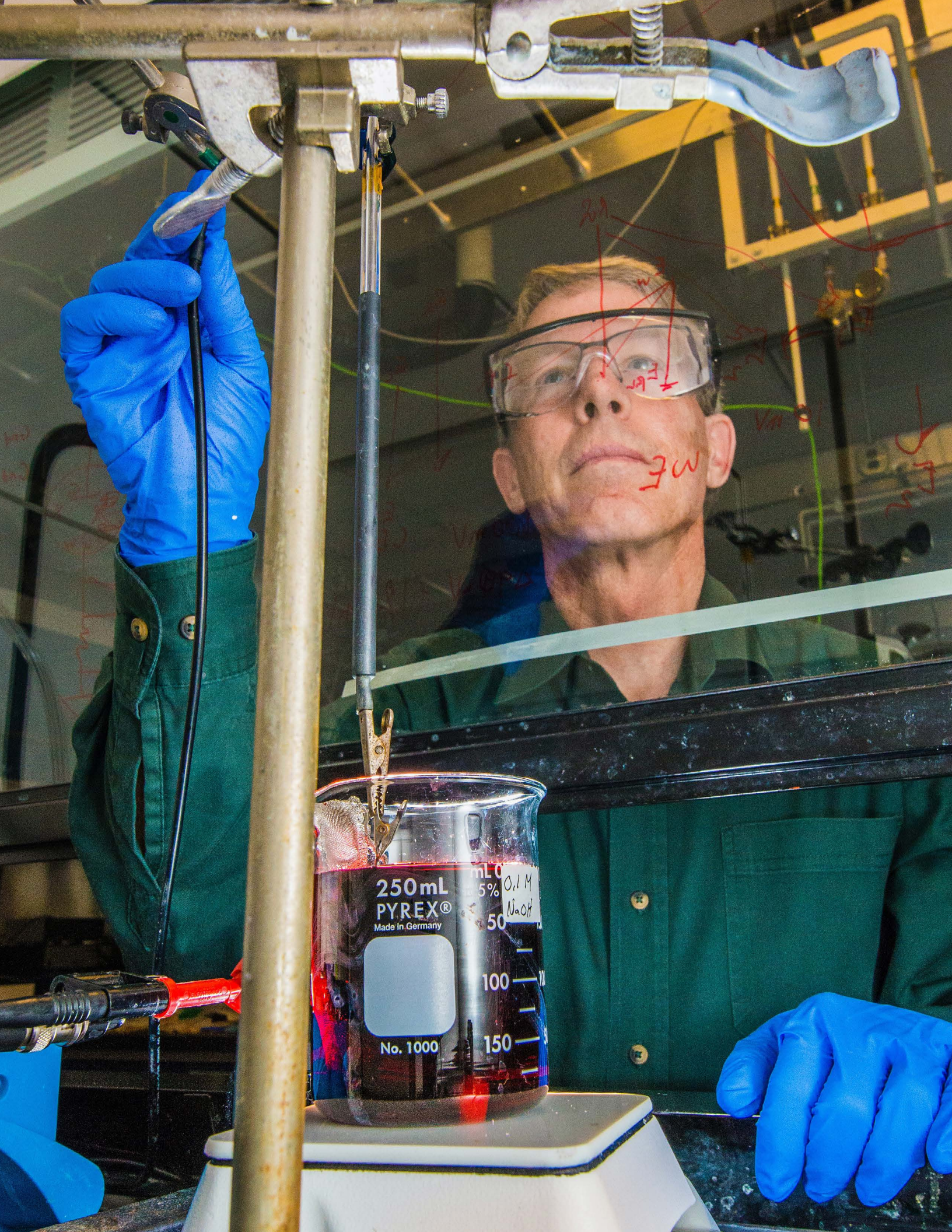
"The community voice oftentimes gets drowned out by certain stakeholders who have the louder voice but may not be representative of the entirety community voice, if that makes sense. And I really am troubled in our county that we have really essentially this very loud, left side of the house, right side of the house. And they're, you know, they're having their dialogue or not even dialogue, they're just back and forth having these discussions and in the middle is the vast majority of people that are really they, they may be weighing in, but they're not engaged. And so, you have to remember that with a grain of salt when you're working with community-based organizations."
 – Jurisdiction 5, High Climate Vulnerability

Having a common goal is vital to the success of any partnership. Establishing ground rules are important in LHD-CBO partnerships.

4. Grants applications are time-consuming and have strict requirements

The LHDs interviewed expressed that applying for grants is time-consuming for both CBOs and LHDs. Some





250 mL
PYREX®
Made in Germany

No. 1000

50
100
150

5% 0.1 M
NaOH

M.F.

V.M.

F.R.

CBOs lack the capacity to develop grant applications. One LHD (n=1) called the grant application process for the CBOs a “risk” because significant work and time is required to complete an application, but funding is not guaranteed. Another LHD indicated that some grant requirements are not favorable for CBOs, as they fail to meet the requirements, like being a registered 501(c)(3) nonprofit. Additionally, some CBOs do not have the capacity to manage the funds which would be received as part of the grant.

FACTORS SURROUNDING THE LACK OF PARTNERSHIPS

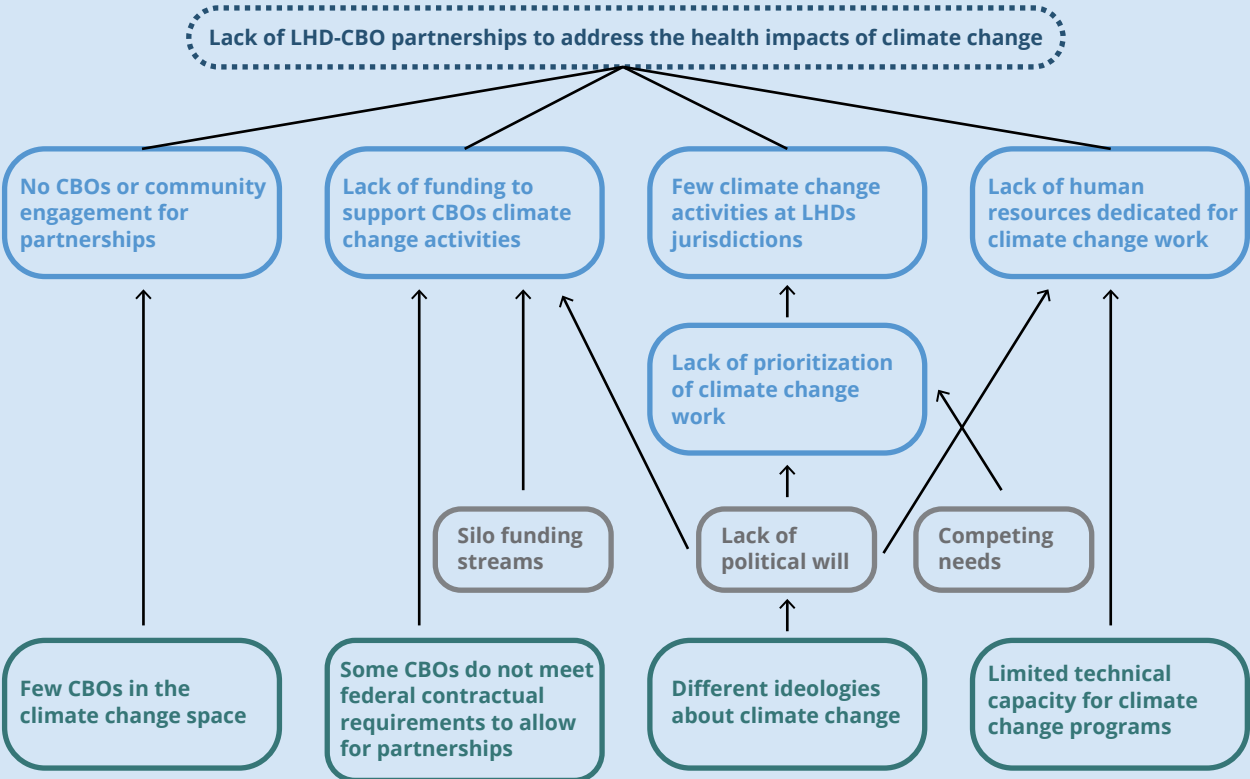
Several of the identified challenges within LHD-CBO partnerships are the reasons LHDs identified a lack

of partnership with CBOs. Furthermore, relatively few CBOs work in the local climate and health space. Eight LHDs (n=8) reported that they did not know of any CBOs that were working on climate change in their community. Figure 8 outlines a root cause analysis (based on LHD interview data) indicating why there may be a lack of LHD-CBO partnerships to address the health impacts of climate change.

IMPACTS OF THE PARTNERSHIPS ON CLIMATE AND HEALTH

The pre-interview questionnaire asked participants if there were any signs in a reduction of health risks due to climate hazards as a result of LHD-CBO

FIGURE 8. FACTORS IMPACTING LACK OF LHD-CBO PARTNERSHIPS TO ADDRESS THE HEALTH IMPACTS OF CLIMATE CHANGE.



Key

- Results
- Consequences
- Contextual Factors
- Root Causes

partnerships in their jurisdictions. Sixty-seven percent of participants (n=12) indicated that there were no signs of a reduction in health risks due to climate hazards, as shown in Figure 9.

The impact of the climate change partnership between LHDs and CBOs has not resulted in any identifiable change in climate indicators within jurisdictions. This response is likely impacted by a lack of data. Fifteen of the 21 jurisdictions we interviewed (85 percent, n=15) did not develop any metrics to monitor the impacts of their CBO partnerships on climate change. Nonetheless, these partnerships have impacted the way the LHDs understand and address the health impacts of climate change. Five LHDs (n=5) reported that the partnerships have raised awareness for climate change and have resulted in increased conversation. LHDs reported that these conversations give climate change work momentum for future engagements.

“Right now, I’m not sure if I’m seeing any impact on climate change other than getting people willing to think about the topic or try to move forward. Or push further to get more momentum.”

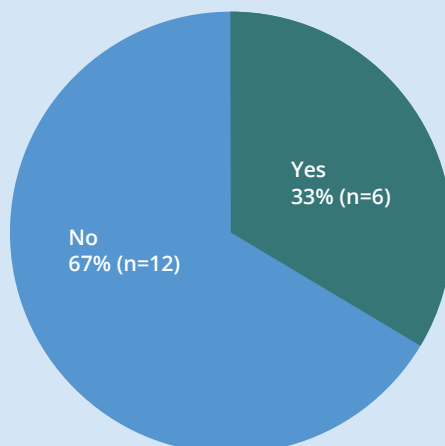
– Jurisdiction 21, High Climate Vulnerability



Some LHDs indicated there was increased participation on climate-related matters by community members because of LHD-CBO partnerships. Key informants expressed that the partnerships have enhanced creativity and innovation for climate change programs within their jurisdiction and encouraged the LHDs to look at climate and health with an equity lens.

FIGURE 9. PRE-INTERVIEW QUESTIONNAIRE DATA ON SIGNS IN A REDUCTION OF HEALTH RISKS TO CLIMATE HAZARDS AS A RESULT OF LHD-CBO PARTNERSHIPS.

Are there any signs in a reduction of health risks due to climate hazards as a result of LHD-CBO partnerships? (n=18)



RECOMMENDATIONS FOR FUTURE PROGRAMMING

The KIs and vulnerability assessment provide a snapshot of 21 urban communities across the country. Utilizing quantitative indicator data on climate hazards and local sensitivity and qualitative interview data from health departments, the project team was able to assess current climate vulnerability and existing activities as well as a potential path forward to help protect the health of people in these communities.

The LHDs interviewed also provided several suggestions for future programming. The key themes of these suggestions were supporting applied research, climate resilience projects, and projects to enhance community cohesion. Below is more detail from the interviews on these recommendations:

Applied Research: Most available climate data are state level. However, when data are collected at the local level it is most commonly on heat and air pollution. While some jurisdictions are conducting climate and health research in their localities LHDs indicated that additional research is needed that provides localized climate data at the city or community level. To help address the needs LHDs have for evidence-based information the following recommendations were made:


- Knowledge, attitudes and practices studies within jurisdictions to better understand the landscape and uncover what kind of climate and health activities are currently being implemented by partners and stakeholders.
- Research about different climate change programs and best practices.
- Research on climate change messaging to address barriers in communities that may not be receptive to health messaging about climate change. This is especially true of communities with carbon-intensive economic activities, as climate change discussions are often centered on employment and

impacts on the economic activity, as opposed to the health impacts of climate change.

- Research partnerships or capacity building, with an emphasis on applied research, as many LHDs indicated that they did not have time nor capacity to conduct this research and would need support.

Climate Resilience Projects: Some LHDs that experience many extreme climate hazards, such as flooding and heatwaves, suggested creating climate resilience projects. While sometimes costly, these projects are vital to protect the health of a community. Some LHDs suggested projects include building shelters for community members who lost their homes to flooding and other natural disasters, building enough permanent supportive housing in the community and creating cooling centers where community members can go when experiencing heatwaves. Some LHDs suggested improving tree canopy within their cities. This would involve tree planting, maintenance and preservation of trees. Improving the tree canopy would help mitigate extreme heat events by providing shade and helping improve the city air quality.

Projects to Improve Community Cohesion: LHDs identified that programs that enhance the cohesion in a community, such as establishing networks and empowering community members' skills to assist their family and neighbors during emergencies, are good



ways to increase their jurisdiction's adaptive capacity. One key informant explained they are seeking funding for a project called "Community Resilience Navigators" which will involve training members in the communities to prepare for flooding and other climate hazards. Participants stated that encouraging different community stakeholders to have open and honest conversations about what should be done during times of crisis would help identify roles that community members play.

HOW CAN PHILANTHROPY OR PUBLIC-PRIVATE PARTNERSHIPS HELP?

In addition to the climate and health projects suggested by the LHDs, the analysis done as part of this project highlight that there is an overall lack of dedicated staff and funding. This severely hampers the ability of health departments to initiate climate adaptation activities. This also limits the ability of health staff to engage in partnerships with CBOs and other critical stakeholders to address the fundamental equity concerns underlying climate impacts on health. The recommendations provide ways that philanthropy or public-private partnerships may assist in advancing local efforts to mitigate and adapt to the changing climate:

Support Funding Needs:

1. Provide direct funding to county and city level health departments to implement local climate change adaptation, mitigation and resilience activities to protect health, based on population size, local needs and vulnerability. E.g., Heat/cold resilient housing or shelters, flood prevention infrastructure, tree-planting
2. Provide direct funding to CBOs for climate and health work.
3. Fund or support LHDs with dedicated personnel for climate change work.
4. Fund applied research on climate change and health, using community-based, participatory study designs. This would help demonstrate the effectiveness of local actions to protect health.

Support Capacity Building and Partnership Needs:

1. Develop capacity building projects for CBOs on grant applications and management.
2. Encourage LHDs to establish formal agreements with CBOs to outline and fortify their partnerships.
3. Develop training programs for public health

professionals on health risks, interventions and opportunities related to climate change.

4. Engage in projects focused on increasing community cohesion, such as establishing networks and strengthening community members' skills to assist their family and neighbors during emergencies. E.g., "Community Resilience Navigators"

Support Research Needs:

1. Conduct localized climate research at the city or community level, perhaps in partnership with universities.
2. Conduct research on the communications models, methods and materials to determine the most effective way to communicate with individuals and communities regarding health-protective behaviors for climate-related health threats.
3. Conduct research on local knowledge, attitudes and practices to better understand the local landscape and uncover what kind of climate and health activities are currently being implemented by partners and stakeholders, and their effectiveness.

ESTIMATED FUNDING NEEDS

As reflected in the recommendations for philanthropy or public-private partnerships above, LHDs indicated a range of funding and technical needs for climate and health activities. Assessments of past climate adaptation grants and cooperative agreements from CDC to health departments found that funding ranged from \$5,000 to \$214,000 per year. The variation in funding was related to a variety of factors including the project scope, target population and funding mechanism. Smaller grants most often support short-term projects that result in a specific product, such as the creation of community-specific fact sheets or translation of existing climate and health documents into additional languages. Larger, multi-year grants were found to be more effective in supporting a jurisdiction's efforts to fully establish a climate and health program, build long-term capacity and implement multiple projects. Below are specific examples of past programs, indicating scope of

work and associated funding, categorized into small, medium and large grants.

Small Grant, Range: \$5,000 to \$25,000

The Kaw Nation (located in what is now called Oklahoma) received a one-time mini grant from CDC and the National Indian Health Board (NIHB) for a project focused on local community education and outreach related to climate and health. Fact sheets and other communications materials were created to help inform community members of potential climate-related threats and steps to protect health. A major focus was the health impacts of heat.

The Boston Public Health Commission developed heat awareness materials and translated them into 10 languages to assist a wide range of communities across the city. These communication tools are designed to reach particularly at-risk populations with the goal of reducing negative health impacts experienced during heat waves.

Alameda County, California will work to improve communication to vulnerable populations on protective actions and smoke alerts to decrease morbidity. Alameda County plans to engage community stakeholders to develop preferred methods to effectively communicate air quality levels and protective actions. They will develop a county communication flow protocol to be used by government agencies when sending smoke alerts and information to disadvantaged communities and those vulnerable to the impact of smoke exposure.

Medium Grant, Range: \$25,000 - \$150,000

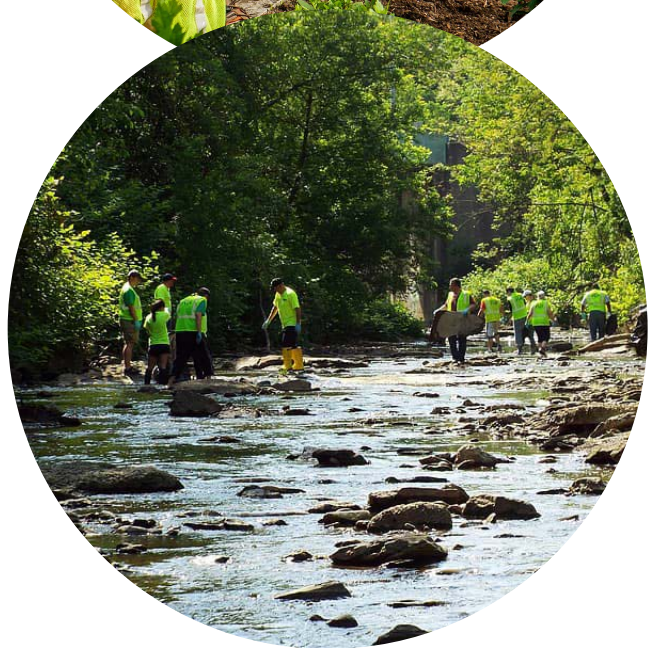
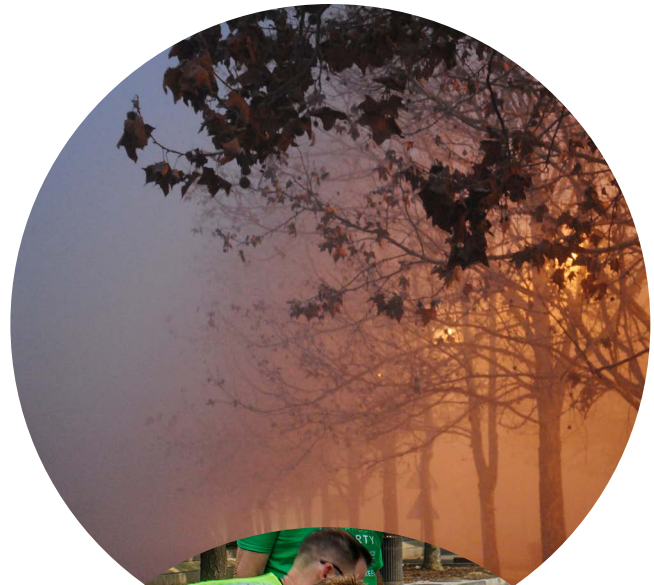
The Swinomish Indian Tribal Community (located in what is now called Washington State) created the "Swinomish Climate Change Health Impact Assessment and Action Plan," tailoring CDC's BRACE framework by using Swinomish-specific health values, definitions and priorities. Extensive community input and "values-driven" data informed the plan. The Swinomish Indian Tribal Community documented

and shared the process with other Tribes so that they may be better informed when moving forward climate change health impact assessments and action plans.

Washington State assessed climate and respiratory health issues. They developed best practice guidance on wildfire communications outreach and tested the utility of low-cost air quality sensors, in measuring risk, during wildfires. They created regional climate and health profiles and climate-related risk communication tools and resources. Localized input was obtained to address specific needs in regions throughout the state. Finally, they helped support local partners in identifying climate-sensitive health risks and generate resilience strategies to inform local planning decisions, including county comprehensive management plans. Washington State plans to provide mini-grants to local health agencies and nonprofit community organizations, as well as host a workshop with local agencies, community organizations and academic partners to share mini-grant learnings and generate next steps to increase consideration of climate change, health and equity in local planning.

Large Grant, Range: Greater than \$150,000

The San Francisco Department of Public Health's Climate and Health Program works to address the local health impacts of extreme heat, flooding, extreme storms, drought, wildfire, allergies and air pollution. The Department does this through the development of vulnerability assessments, literature reviews, emergency plans, data analysis, mapping, outreach, engagement with CBOs, engagement with other stakeholders and working interdepartmentally to bring a health perspective to citywide climate action and preparedness efforts. San Francisco is particularly vulnerable to the health impacts of extreme heat. A study of a 2006 California heat wave found that during extreme heat events, San Francisco's emergency department visits increased more than almost anywhere else in the state. The Climate and Health Program has helped San Francisco prepare for future extreme heat events by informing the city's extreme heat emergency response plan, developing





and deploying extreme heat preparedness trainings (specifically for older adults) and teaching local clinicians how to discuss extreme heat preparedness with their patients.

The New York City Climate and Health Program (NYC CHP) focuses on the health impacts of current and future climate-related hazards, primarily, extreme heat, extreme cold and power outages. The program relies on several approaches to analyze the magnitude of these impacts and assess which populations and communities are most at risk to these impacts. In addition, the program works to ensure that health is a consideration in larger, multi-

sectoral planning or resiliency initiatives. The program does this by helping to prioritize local communities for climate mitigation and adaption investments. One example is the NYC Heat Vulnerability Index, developed by NYC CHP and Columbia University, which provides an understanding of how the risk for dying during a heat emergency varies across neighborhoods. To achieve success, the program relies heavily on partnerships with internal sister agency programs including the Air Quality Program, the Environmental Public Health Tracking Program, Healthy Homes, Office of Emergency Preparedness and Response and the Center for Health Equity.



LIMITATIONS

This landscape analysis provides a snapshot of the climate vulnerability, the climate and health assets and barriers and recommendations for building climate and health capacity based on 21 urban jurisdictions assessed. There are several limitations to these findings, some due to limited data availability and others due to the limitations of the methods used.

The non-randomized nature of this landscape analysis provides a snapshot into the 21 LHDs interviewed and does not provide a comprehensive picture of climate and health programs within all LHDs in the United States. Additionally, conducting KIIIs presented challenges resulting in limitations. Data collection was occurring during the 2020 COVID-19 pandemic. Public health staff were being furloughed or reassigned to the COVID-19 response, resulting in many LHDs inability to participate. Five LHDs provided reasons for non-participation with 80 percent indicating limited capacity due to the LHD's COVID-19 response activities. Twenty-one interviews with LHDs were completed and each met the pre-determined considerations for inclusion, however there was less geographic diversity than originally planned (i.e., 19 states were represented rather than 21). Of the 21 LHDs interviewed, 20 were city or county LHDs and one (Rhode Island Department of Health) was a state health department. The Rhode Island Department of Health was included because: 1) it is an LHD that serves an urban environment per the inclusion criteria; 2) there is no other health department in the state of Rhode Island; and 3) the state is geographically small and the city of Providence is included in the jurisdiction of the Rhode Island Department of Health.⁸

The methods and data used in the climate vulnerability assessment also present limitations. The adaptive capacity scores from the climate vulnerability assessment are based on interview

data, which showcase the views, perceptions and opinions of participants. The leads on climate and health within the LHDs were interviewed so that the KIIIs would provide as detailed information as possible. Nonetheless, there is a risk of recall bias; certain information could have been erroneously omitted by the participants. The assessment included information related to partnerships with CBOs however this was derived from the interviews with LHDs; no CBOs were interviewed. Additionally, the climate exposure scores for three jurisdictions were calculated with missing data points: ozone data for two jurisdictions and annual PM2.5 for one jurisdiction. To account for these missing values, the average of the metric across the jurisdictions was applied. This introduces some potential for error but prevents the climate hazards in these jurisdictions from being categorically underestimated. It is important to note that the adaptive capacity scores are based on the LHDs interviewed and thus represent the entire jurisdiction of the LHD, whereas the climate exposure and sensitivity data were gathered at the city level. Most LHDs interviewed were city or county level and thus the climate exposure at the city was likely a good proxy for that of the jurisdiction, but some counties include a much wider jurisdiction beyond the city. There may be different levels of climate sensitivity within the city versus within the county.

Lastly, climate and health data at the city and county level are sparse, and most LHDs do not present information about climate change on their websites.



An article published in April 2020 in the *American Journal of Public Health* found that only “1.6 percent of county and 3.9 percent of city websites provided clear ways to find climate change information, whether through provision of original content or links to external agencies’ websites. Among websites providing original content, 48 percent provided no explanation of climate change causes.” The impacts of climate change on health are a relatively new area of interest in most LHDs, as previously described from the KII data. The lack of available data on the local health impacts of climate change may have contributed to the LHDs feeling inadequately informed to respond to some interview questions.⁹

Despite the limitations of the study design and available data, the information provided in this landscape analysis provides insight into some of the challenges, successes and barriers for LHDs when conducting climate and health activities. Many of the identified barriers are related to limited capacity and funding, however a clear desire and need for LHDs and CBOs to engage in this work was also expressed. The recommendations highlighted in this report provide some ways that philanthropy or public-private partnerships may assist in advancing local efforts to mitigate and adapt to the changing climate. Partnering with CBOs will help ensure projects are aligned with the needs of the community, and all the LHDs interviewed saw great value in those partnerships.

APPENDIX A: SUMMARY OF EXISTING EVIDENCE ON HEALTH DEPARTMENT CAPACITY TO ADAPT TO CLIMATE CHANGE

In 2008, NACCHO conducted an online survey of a nationally representative sample of LHD directors to assess the readiness of health departments to prepare for and address the health effects of climate change.

“In 2012, 87 percent of LHD directors believed that their agencies did not have sufficient resources to effectively protect local residents from the health impacts of climate change.”

– NACCHO “Are We Ready” report

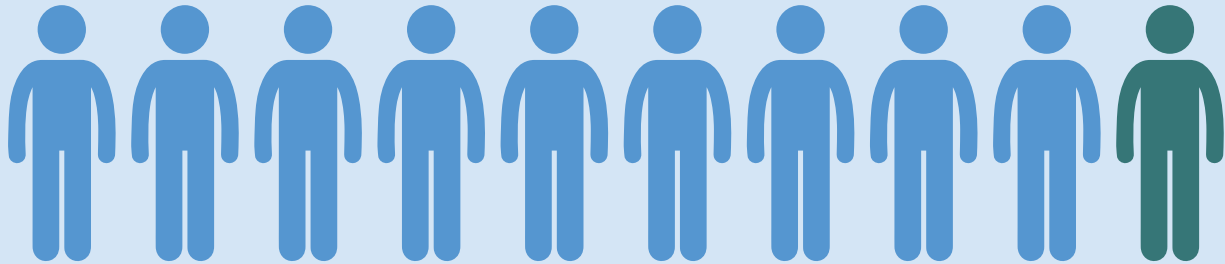
While most health department directors acknowledged climate change as a serious threat to their jurisdictions, the directors were not confident in their health department’s ability to assess health impacts of climate change and conduct adaptation and mitigation planning. In response to these findings, between 2008 and 2012, NACCHO assessed the current perceptions of their agencies’ readiness to prepare for and address the health effects of climate change and assessed changes in such perceptions.

Similar to 2008, the majority of health department directors believed that there was a lack of necessary expertise within their health department to develop climate adaptation plans (80 percent) and there was a lack of sufficient resources to protect their community from climate change impacts (87 percent).^{10,11} Nearly nine out of 10 health directors at LHDs believe they lack sufficient resources needed to protect their

communities from the health impacts of climate change. Many health departments are not connected with local health equity and environmental justice groups working on climate change, who have the localized knowledge, resources and community connections the LHDs need. A 2018 report authored by the Public Health Institute with support from the American Public Health Association (APHA), The Kresge Foundation and CDPH, was designed to help local public health departments integrate climate change and health equity into practice. The report, titled [“Climate Change, Health and Equity”](#), found that local public health departments in the United States are working to address health inequities by changing community environments (such as transportation, land use, agriculture, food and criminal justice systems), changing the economic, physical and social conditions in which we live, work, learn and play, and addressing the historical and structural determinants of health (such as racism, power and disenfranchisement). LHDs are now broadening their scope to include climate change — a defining health challenge of this century.^{11, 12}

The Bay Area Regional Health Inequities Initiative (BARHII) conducted interviews with 20 LHDs and five subject matter experts around a state-local partnership structure to address climate change. The participants noted that LHDs would benefit from sustained funding for climate change mitigation and adaptation efforts and recommended basing allocations on an equitable funding formula

LHDS ARE ALREADY DEALING WITH THE HEALTH IMPACTS OF CLIMATE CHANGE IN COMMUNITIES ACROSS THE UNITED STATES. HOWEVER, NEARLY 9 OUT OF 10 HEALTH DIRECTORS BELIEVE THAT THEIR LHD LACKED SUFFICIENT RESOURCES NEEDED TO PROTECT THEIR COMMUNITIES FROM THESE HEALTH IMPACTS.¹¹



accounting for population size, local needs and vulnerability. Suggested funding amounts varied, ranging from \$50,000 for smaller health departments to \$500,000 for larger health departments. Funding would be utilized for dedicated staff, meeting costs, community engagement, technical assistance and content development.¹³

A study conducted by Grossman et al. in 2019 highlighted the successes and challenges associated with the mini-grant approach for climate change preparedness used by six state health departments funded through CDC's CRSCI and implementing the BRACE framework. The research examined the effectiveness of state health departments providing funding to LHDs for climate adaptation activities. The mini grants ranged from \$7,700 to \$28,500 and aimed to increase capacity, develop new external health department partnerships and create adaptation plans in cities in the following states: California, Florida, Illinois, New Hampshire, Oregon and Wisconsin. Some of the successes of the mini-grant projects included increased engagement with diverse stakeholders, building climate change into existing programs and policies, an increase in knowledge about climate change among health department employees and focused efforts to identify vulnerable communities and populations. Challenges of the mini-grant projects included political sensitivity and long-term sustainability. Despite these challenges, the mini

grants provided an avenue for health departments to increase their capacity to address the impacts of climate change.¹⁴

The California Building Resilience Against Climate Effects (CalBRACE) project by the California Department of Public Health (CDPH) provides an additional example of how states can support LHDs in implementing and evaluating capacity building activities to address the health impacts of climate change beyond providing funding. CalBRACE developed tools for LHDs to reduce climate exposure and vulnerability in order to plan targeted adaptations programs. The tools included educational, training and promotional materials, curricula, guidance and frameworks. Furthermore, CDPH hosted convenings for LHDs and disseminated monthly email updates to foster communication and availability of resources around climate change. Lastly, CDPH engaged key stakeholders to inform the evaluation framework of CalBRACE and ensure ongoing monitoring and evaluation.¹⁵

APPENDIX B: DESCRIPTION OF PROJECT TEAM

The CDC Foundation provided grant administration and oversight for the project, working closely with CDC, The Kresge Foundation and partner organizations to coordinate the program as well as provide administrative and technical assistance. CDC provided technical assistance, expert advice and guidance throughout the development and implementation of this project.

This project supports CDC's mission to strengthen health departments and communities in carrying out evidence-based public health and CDC's role in developing the science base for public health strategies and interventions and the materials and guidance to support health departments and localities. This project also directly aligns with the stated objectives of CDC's Climate and Health Program and aligns closely with the existing Climate-Ready States & Cities Initiative, but with a focus on local adaptation capacity. The focus on health equity further aligns with CDC's Building Resilience Against Climate Effects (BRACE) framework, which requires an assessment of vulnerabilities.

The CDC Foundation has played a vital role in the response to extreme weather events and shifts in vector-borne disease, which are predicted to increase in severity as climate change continues. The CDC Foundation's Emergency Response Fund was first activated in 2005 to support the public health response to Hurricane Katrina. The Fund provides immediate, flexible resources to CDC experts addressing emergencies that affect the public's health.

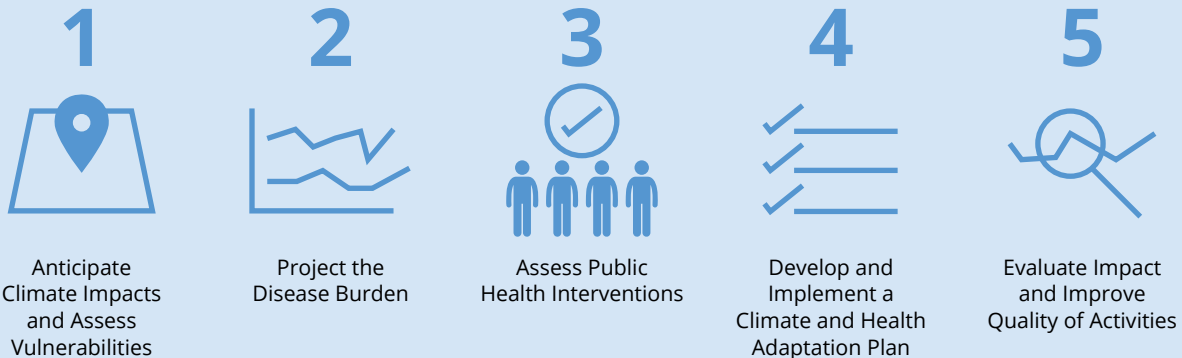
The Fund has since supported emergency response efforts for the Zika outbreak, Southern Asian tsunami and multiple hurricanes. The CDC Foundation has also supported health departments in U.S. territories, who are experiencing the most immediate impacts of climate change. The Hurricane Jurisdictional Disaster Reconstitution Management Project continues to provide hurricane recovery support in the U.S. Virgin Islands through the procurement of essential equipment and training of health department staff.^a

The CDC's Climate and Health Program created a framework for use by health agencies in adapting to the health effects of climate change. [The Climate-Ready States & Cities Initiative](#) (CRSCI) supports 16 states and two cities in implementing this framework with their partners and local communities. In addition, CDC works with partners to support territories and tribes to implement actions to protect health from climate-related impacts. The CRSCI was further expanded in 2019 and 2020 through the establishment of mini-grants, smaller one-year projects administered through cooperative agreements with nonprofit partners: the National Environmental Health Association (NEHA), the

^aTo foster cross-learning and data sharing, the CDC Foundation collaborated with several partners throughout this project but worked most closely with the Trust for America's Health (TFAH). The CDC Foundation and TFAH were both funded to assess different segments of the public health sector regarding preparedness to respond to weather-related emergencies. Both projects sought to develop an instrument to assess readiness, use the instrument to collect data, analyze the results and create recommendations to strengthen weather-related preparations. In completing the respective assessments, the CDC Foundation and TFAH collaborated to inform and align methods and data gathering tools, participating in and sharing our lists of expert advisory groups (composed of health officials, emergency preparedness personnel, and climate experts), and sharing and reviewing results from our assessments.

CDC'S THE BUILDING RESILIENCE AGAINST CLIMATE EFFECTS (BRACE) FRAMEWORK

The BRACE framework is a five-step process that allows health officials to develop strategies and programs to help communities prepare for the health effects of climate change. Part of this effort involves incorporating complex atmospheric data and both short- and long-range climate projections into public health planning and response activities. Combining atmospheric data and projections with epidemiologic analysis allows health officials to more effectively anticipate, prepare for and respond to a range of climate sensitive health impacts.¹⁹



National Association of County and City Health Officials (NACCHO), and the Council for State and Territorial Epidemiologists (CSTE). From 2010-2020, a total of 43 cooperative agreements focused on health adaptation granted to 39 jurisdictions were implemented. While most of these grants went to states and Tribes, multiple counties and cities have been directly funded. See Figure 10 for a map of all CDC climate grant recipients and partner mini grants, including previously funded jurisdictions from 2010-2020.

Climate & Health Program

CDC's Climate and Health Program has provided direct funding and technical assistance to two LHDs through the CRSCI for the past nine years, as well as additional mini-grants and technical assistance

to dozens of other local jurisdictions through collaborative efforts with partner organizations. For example, CDC partners with NACCHO and provides funding and assistance to further aid local health departments on climate adaptation activities. NACCHO's [Global Climate Change Workgroup](#), supported by CDC, produced [a guidance document for LHDs](#) suggesting actions for LHDs to take to begin examining the local health impacts of climate change. CDC's technical assistance to LHDs ranges from guidance on evaluation and project planning to assistance with highly technical epidemiologic methods. CDC has also provided extensive assistance to unfunded LHDs, and has a [series of resources](#) for LHDs and communities working on climate and health.^{16,17,18}

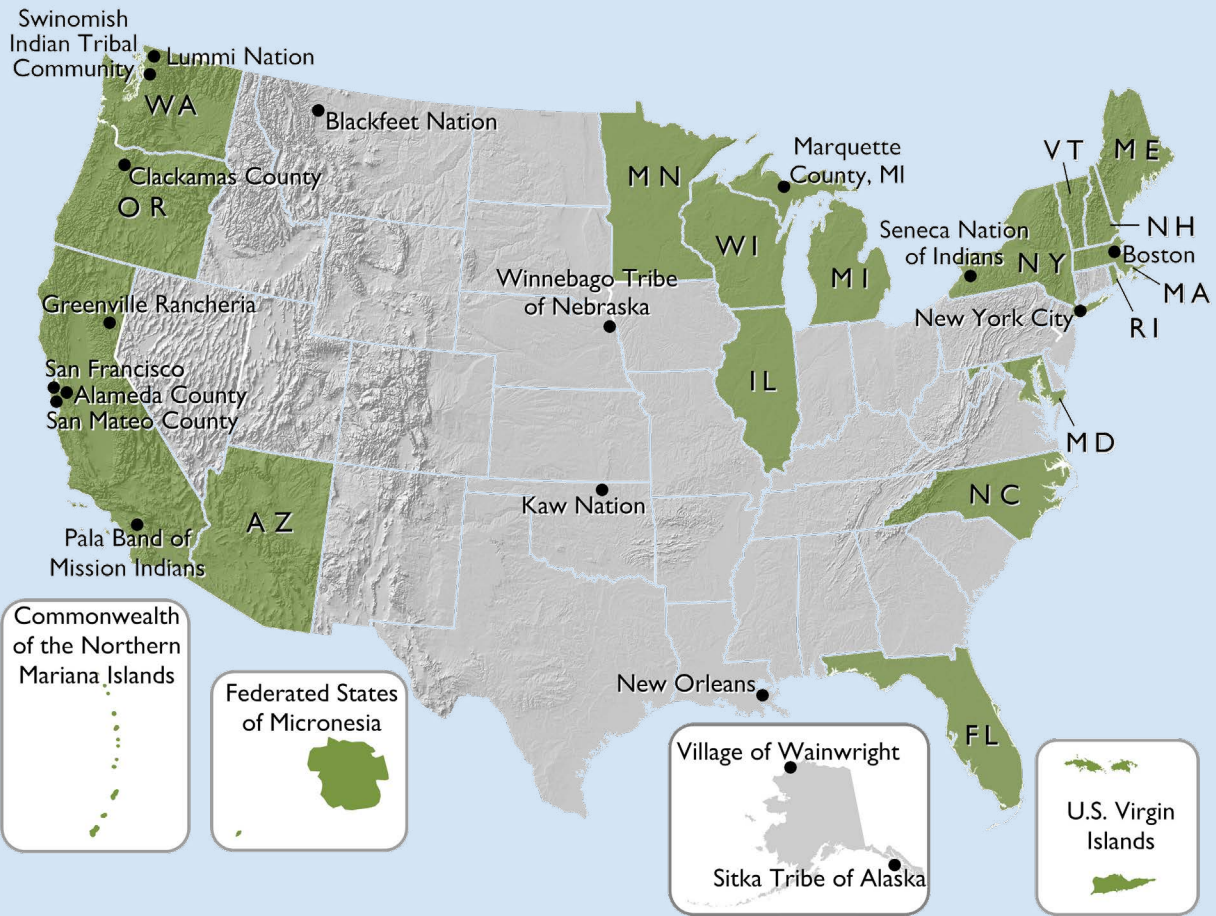
The CDC-funded state health departments also have extensive experience working with local community groups and health departments, including provision and oversight of mini-grants. These grants from CDC-funded CRSCI states to local jurisdictions have been an effective method of supporting local climate and health efforts. While not required as part of the BRACE framework, several states receiving CDC funding have distributed competitive grants to

cities and counties within their states. These grants facilitate capacity building, forging partnerships with entities outside of health departments, incorporating climate change information into existing programs and developing adaptation plans, while streamlining collaboration across multiple levels of government. Surveys of grant recipients found increases in knowledge, engagement with diverse stakeholders and the incorporation of climate change content into existing local programs. CDC continues to work closely with state health departments, many of which have climate and health adaptation plans that include local activities, to coordinate technical assistance to LHDs.¹³

The Kresge Foundation’s Climate Change, Health & Equity (CCHE) initiative

launched in early 2019 as a partnership between The Kresge Foundation’s Environment and Health programs. This initiative seeks to mobilize a strong constituency for equitable climate action within health care institutions, among health practitioners and among community-based advocates in a way that is responsive to the needs and priorities of low-income, urban communities. The initiative builds on years of work supported by The Kresge Foundation at the intersection of climate change, health and equity, and includes three distinct, but aligned strategies that seek to: 1) build the capacity of health care and public health institutions

FIGURE 10. MAP OF ALL CDC CLIMATE GRANT RECIPIENTS AND PARTNER MINI-GRANTS, INCLUDING PREVIOUSLY FUNDED JURISDICTIONS, 2010-2020.





THE KRESGE FOUNDATION



as leaders in promoting climate resilience and advocating for beneficial climate policies; 2) shift the practice of health care and public health practitioners so they engage in climate advocacy, influence public policy efforts important to climate resilience and incorporate climate change into their practice; and 3) strengthen the leadership of community-based advocates to accelerate the implementation of policies that improve climate resilience and reduce health risks equitably.

The initiative's community-based strategy includes a 14-month planning phase and three-year implementation phase. In August 2019, The Kresge Foundation awarded 15 community-based nonprofit organizations 14-month planning grants to advance policy solutions aimed at improving climate resilience and equitably reducing health risks in low-income communities in cities across the country. During the planning period, planning grant recipients will work with a set of project partners from other sectors to develop multi-year work plans that address community-defined health and climate priorities. This report was created through support from the CCHE initiative.

APPENDIX C: METHODOLOGY

The project team conducted a landscape analysis to assess the climate and health capacity and needs in a subset of urban communities and LHDs. The purpose of this analysis was to inform recommendations on how to build capacity within communities working to reduce the health impacts related to climate change.

The landscape analysis involved holding an expert stakeholder meeting to inform the approach of this project and an environmental scan of a select number of urban jurisdictions. The environmental scan included a pre-interview questionnaire of LHDs, KIIs with LHDs and the analysis of climate and health indicator data for these jurisdictions. See Figure 11 for an overview of the approach taken to complete this landscape analysis.

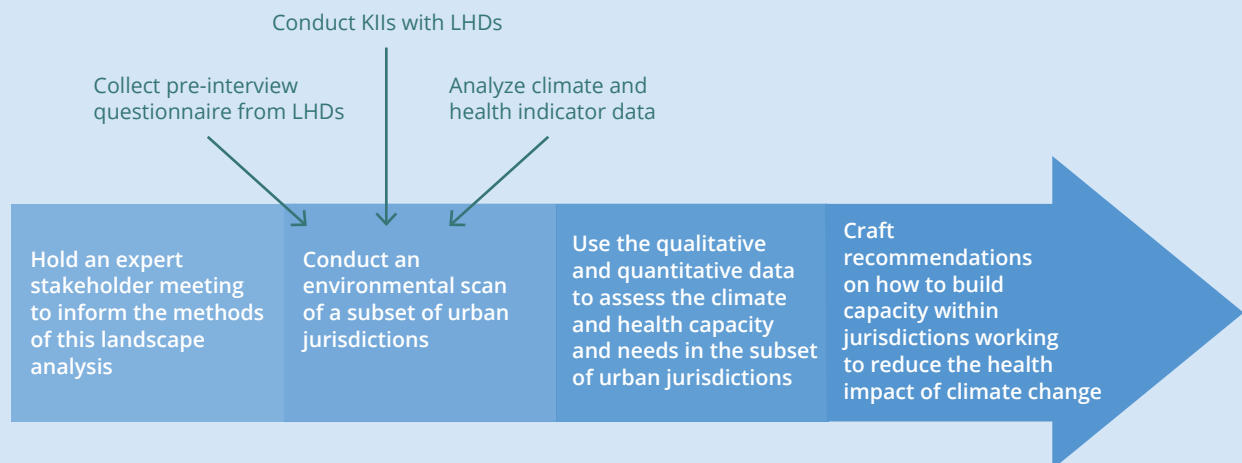
EXPERT STAKEHOLDER MEETING

The expert stakeholder meeting convened in October 2019 with a subset of LHDs. The purpose of the

meeting was to inform strategies for the landscape analysis and identify needs related to health inequities and climate change. Nineteen stakeholders, from CBOs, LHDs, academia, philanthropy, regional commissions, national professional organizations, advocacy groups and research groups working at the intersection of the climate change and health fields attended the meeting. See Figure 12 for an outline of the objectives and outputs of the meeting. The expert stakeholder meeting materials can be found in [Appendix D: Stakeholder Meeting Materials](#).

Senior leadership at the CDC Foundation and CDC provided opening remarks, and members of the

FIGURE 11. OVERALL APPROACH OF THE LANDSCAPE ANALYSIS.



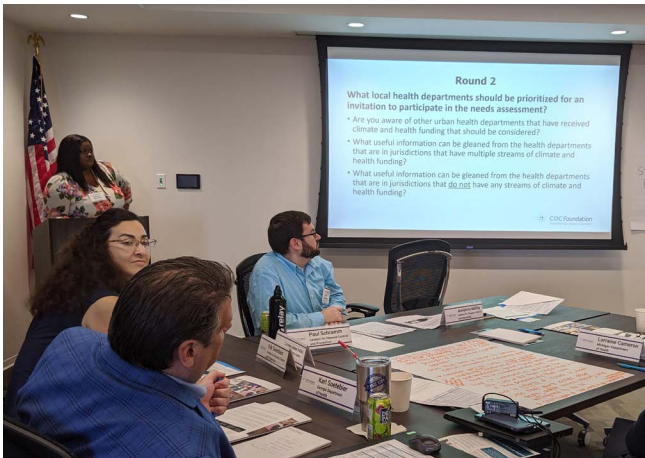


FIGURE 12. OBJECTIVES AND OUTPUTS OF THE EXPERT STAKEHOLDER MEETING.

Meeting Objectives

1. Discuss how local health depts., CBOS and other key stakeholders are currently working to prepare and implement strategies to reduce the climate-related health impact within their communities, with a focus on communities who are disproportionately at risk.
2. Identify examples of existing collaborations between local health depts. and CBOS.
3. Provide feedback regarding the landscape analysis framework and methodology.
4. Conclude the meeting with actionable next steps for the CDC Foundation Program Manager.

Meeting Outputs

1. Information and recommendations to inform the landscape analysis
2. A prioritized list of potential local health depts. for the landscape analysis
3. A refined framework used to assess local health depts.



project team issued an overview of The Kresge Foundation's CCHE initiative and CDC's Climate and Health Program to provide context for the stakeholders. Five stakeholders gave 10-minute lightning presentations about their climate and health work at the local level, best practices and challenges associated with their climate and health work, stories of collaboration with other partners and examples of needed resources that would strengthen their ability to conduct climate and health work.

Defining the LHDs: Following the lightning presentations, the CDC Foundation Program Manager presented a proposed approach and methodology for the landscape analysis. The assessment would focus on urban health departments, with and without funding, to implement climate and health activities.

Creating the instrument: Stakeholders proposed the landscape analysis adapt the instrument from NACCHO's "Are We Ready?" study, an online survey administered to LHD directors. The list of survey questions this project used are detailed below. Questions one through four are from the "Are We Ready?" study and the remaining questions were

created by the project team.

1. What are the perceptions of the existence, causes and dangers of climate change?
2. What are the perceptions of the past and future impacts of climate change in your jurisdiction?
3. What are the perceptions of LHD prioritization of climate change (compared to other priorities) and existing capacity to assess and address the impacts of climate change within your jurisdictions?
4. What activities, both current and planned, are taking place within your jurisdiction related to climate change, including mitigation-related efforts?
5. What are the existing partnerships within your jurisdiction to address climate change?
6. What partnerships are needed within your jurisdiction to address climate change?
7. How are you incorporating health equity in climate change efforts?
8. What resources are needed to advance climate and health adaptation work in your community?

Defining the criteria: After the CDC Foundation Program Manager provided an overview of the proposed methodology for selecting health departments and for conducting the landscape

TABLE 2. STAKEHOLDER RECOMMENDATIONS FOR LHD INCLUSION CRITERIA.

Stakeholder Recommendations for LHD Inclusion Criteria	
Geographic region	City population
Experience with equity	Climate hazards
Demographics	Susceptible populations
Coastal versus non-coastal	Urban versus rural

analysis within the selected health departments, the stakeholders were placed in small groups. In small groups, the stakeholders brainstormed inclusion criteria for inviting health departments to participate in the analysis. The stakeholders also discussed ways to assess the climate and health capacity of LHDs, what instruments would be used and data collection options. Each small group consisted of stakeholders from differing backgrounds (foundations, health departments, CBOs, environmental justice and health equity experts) to ensure a range of perspectives during the discussions. A facilitator from the project team was stationed with each group to take notes and provide guidance.

When discussing the inclusion criteria, the stakeholders identified several areas to consider to ensure the LHDs selected were diverse. One group recommended considering geography, climate impact and community engagement. Another group added that a continuum of low-, medium- and high-capacity health departments serving cities that are most impacted by climate hazards be considered. Some suggested using available funding for climate and health as an indicator for capacity. Others suggested looking at existing programs. The other groups provided feedback stressing the need to include indicators of equity. These criteria are described in Table 2.

Stakeholders agreed that a variety of mutually beneficial activities and partnerships should be assessed, noting to, “look for activities and partnerships that advance multiple goals.” Stakeholders identified emergency management

organizations, nongovernmental organizations (NGOs), faith communities, local agencies (like housing, transportation, CBOs, human services, workforce development, planning), academia, environmental justice and civil rights groups as viable partners to health departments.

Finally, stakeholders recommended that the landscape analysis include a balance of quantitative and qualitative data collection methods including surveys, interviews and focus groups of employees at health departments, partner agencies and members of the community. One group recommended using the National Association for the Advancement of Colored People (NAACP) Climate Resilience Indicators and CDPH’s climate change and health vulnerability indicators to assess cities’ resilience capacity and needs. Stakeholders also recommended the project team consider geographic region, experience with equity, city population, climate hazards, demographics, susceptible populations, coastal versus non-coastal and urban versus rural when developing methods for the landscape analysis.

POST-MEETING METHODS REFINEMENT

Following the stakeholder meeting, the CDC Foundation and CDC met with The Kresge Foundation to discuss the feedback provided by the stakeholders and present a revised approach for the landscape analysis. The project team decided to complete a landscape analysis which included conducting an environmental scan of the identified jurisdictions. An environmental scan is used to assess internal strengths and challenges and external opportunities

and threats. The environmental scan consisted of KIIs and collection and analysis of indicator data.^b

The central question of the environmental scan was: **How do partnerships between LHDs and CBOs impact a community's ability to manage health threats from climate change?** The

process for the environmental scan involved first gathering information using a scan of jurisdictional documentation specific to climate change action.

1. Gather data on climate exposure and sensitivity from online databases.
2. Develop and administer a survey to identified stakeholders at LHDs to gain insight on existing partnerships within the jurisdiction and identify willing participants for follow-up interviews.
3. Conduct KIIs with willing participants.
4. Analyze information gathered in the background review, online survey responses and KIIs to determine community vulnerability, assets and gaps.
5. Present conclusions and recommendations in a final report.

KEY INFORMANT INTERVIEWS METHODS

As part of the environmental scan, the project team conducted KIIs with staff at LHDs who are involved in or lead climate and health work. This was to gather much-needed data on city and county-level climate and health activities, successes and needs. After the stakeholder meeting, 20 LHDs were identified to participate in a KII. When selecting the health departments, the following considerations were made (See Table 3).

The data from these interviews and from the jurisdictions' relevant climate action plans were used to describe climate and health activities, assets, best practices, barriers, partnerships with CBOs and ultimately to inform the recommendations for future programming.

Recruitment and Data Collection Procedure

Participant recruitment began in April 2020. The project team sent an invitation recruitment email (see [Appendix E: Recruitment Materials](#)) to 20 employees of the originally identified LHDs. The project team invited 20 participants because research supports this number of participants allows for data saturation.^{c,20,21}

Data collection began in May 2020. Because data collection was occurring during the 2020 COVID-19 pandemic, many of the 20 originally identified LHDs were unable to participate. To address this issue, the project team identified contacts at an additional 25 LHDs who met the considerations for LHD inclusion. The project team sent the invitations to contacts at these additional LHDs and asked our partners to distribute the invites within their networks.^d

Ultimately, the project team and partners sent over 300 invitations and the project team completed 21 interviews. See Figure 13 and Table 4 below. LHD employees were invited to complete an online survey (Pre-Interview Questionnaire) and provide consent and contact information to participate in KIIs.^e All participants provided voluntary informed consent. The CDC Foundation and CDC's National Center for Environmental Health (NCEH) determined the

^b Decision makers use environmental scans to collect, organize and analyze data on their assets and shortcomings in external and internal environments and to guide strategic planning and decision making. Environmental scans focus on acquiring relevant and credible information through various methods, including literature reviews, online database assessments, social media scanning, policy reviews, competitor appraisal and solicitation of stakeholders' opinions. When properly executed, this process leads to a series of evidence-based responses that an organization can use to improve strategy and performance.

^c A qualitative approach requires sacrifices in terms of generalizability and comparability, and a small, non-randomized sample size allows researchers to explore and understand the experiences, opinions and perspectives of their informants in greater depth.

^d The following partners assisted with recruitment efforts: Emerging Leaders in Public Health program, NACCHO Climate and Health Workgroup, APHA Environment Section and CSTE Climate, Health and Equity Subcommittee.

^e LHD employees received reminder emails to participate in KIIs at two-week intervals until the end of the data collection period in July 2020.

TABLE 3. CONSIDERATIONS WHEN SELECTING LHDS FOR INCLUSION.

Considerations	Definition	Rationale
Must be a local health department	The health department must be local as defined by NACCHO: “the governmental public health presence at the local level; a locally governed health department, a branch of the state health department, a state-created district or region, a department governed by and serving a multi-county area, or any other arrangement that has governmental authority and is responsible for public health functions at the local level”	Allows assessment of local health capacity; in alignment with CDC’s BRACE framework which targets health departments; allows for assessment of relationship between health departments and CBOs
Must serve an urban environment	The jurisdiction must include a city as defined by the U.S. Census: “densely populated urbanized areas of 50,000 or more population”	This assessment focused on urban populations
Subset of LHDS must be geographically diverse representation	The selected LHDS must be geographically diverse as defined by U.S. Census Divisions and National Oceanic and Atmospheric Administration (NOAA) U.S. Climate Regions	Allows for assessment across all areas of the country

landscape analysis and environmental scan to be non-research, so ethical clearance was not sought. Participants were offered a \$10 Starbucks gift card as an incentive for their participation.

Data Collection Instruments Pre-Interview

Questionnaire: The pre-interview questionnaire served two purposes.^f First, it was intended to schedule the KIIs. Second, the pre-interview questionnaire captured the potential climate changes and impacts the LHD was anticipating in their city, whether the LHD characterized being in a stage of climate adaptation or climate mitigation, whether the LHD currently partners with any CBOs for climate work, the number of partnerships with CBOs the LHD currently has, the strength of those partnerships and if there have been any signs in a reduction of threat to climate hazards as a result of their partnerships. For

the full pre-interview questionnaire, see [Appendix F: Data Collection Instruments](#).

Key Informant Interview Tool: The KII tool included 16 questions and was designed to obtain information related to current and anticipated climate hazards within the jurisdiction, existing and planned climate adaptation work taking place in the jurisdiction, barriers and facilitators to climate change mitigation and adaptation, how health equity is being addressed in climate and health work, how LHDS engage or do not engage with CBOs, the impact of these partnerships on climate change, resources needed to further support engagement efforts with CBOs and ideas for future projects between LHDS and CBOs related to climate resilience. For the full KII tool, see Appendix F: Data Collection Instruments.

^f The pre-interview questionnaire was administered using Google Forms.

FIGURE 13. MAP OF 21 LHDS INTERVIEWED.



Data Collection and Management

The project team received a total of 18 pre-interview questionnaires and conducted 21 KIIs with individuals occupying key climate positions in the LHD (three KII participants did not complete the pre-interview questionnaire).^g The pre-interview questionnaire took approximately 15 minutes to complete. The KIIs took no more than 60 minutes and were either voice or video calls depending on the participant's preference.^h The project team used an online transcription service to transcribe the interview recordings, anonymized the transcripts and uploaded the transcripts to a secure server.ⁱ The project team analyzed these data in aggregate in order to protect the identities of the interviewees.

^g Participants selected a time for their KII using Doodle online meeting scheduler.

^h Zoom Video Communications platform was used to conduct the KIIs.

ⁱ Rev transcription software was used. Files were saved in a password-protected Dropbox.

Data Analysis

The project team used NVivo qualitative software to code and analyze the KIIs. The team employed a deductive coding approach, developing a list of predefined codes that informed the codebook. Study objectives and questions, interview protocols and overarching themes that emerged during data collection were used to develop the predefined codes. The codebook served as the tool to organize and subsequently analyze the information gathered in the interviews. The codebook was modified as new themes and findings emerged during data analysis. The project team characterized the prevalence of responses, examined differences among participants and identified key findings that addressed the study objectives.

CLIMATE VULNERABILITY ASSESSMENT METHODS

To accurately identify the health impacts climate change will have on the communities assessed in this report, the project team sought to understand

local climate-related exposures, sensitivity of the population and existing adaptive capacity in the community. These three factors result in an overall measure of climate vulnerability. As part of this environmental scan, the project team used quantitative indicator data to measure local climate

TABLE 4. TABLE OF 21 LHDS INTERVIEWED.

State	County	Primary City Jurisdiction	Health Department
AZ	Pima	Tucson	Pima County Health Department
CA	San Francisco	San Francisco	San Francisco Department of Public Health
CO	Denver	Denver	Denver Public Health
GA	Dekalb	Brookhaven	Dekalb County Board of Health
KY	Jefferson	Louisville	Louisville Metro Department of Public Health and Wellness
LA	Orleans Parish	New Orleans	New Orleans Health Department
MA	Norfolk	Brookline	Brookline Department of Public Health
MI	Washtenaw	Ann Arbor	Washtenaw County Health Department
MN	Hennepin	Minneapolis	Minneapolis Health Department
MO	St. Louis	St. Louis	City of St. Louis Department of Health
OH	Franklin	Columbus	Franklin County Public Health
OK	Oklahoma	Oklahoma City	Oklahoma City-County Health Department
OR	Lane	Eugene	Lane County Public Health
RI	Providence	Providence	Rhode Island Department of Health
TX	Travis	Austin	Austin Public Health
TX	Harris	Houston	Harris County Public Health
UT	Salt Lake	Salt Lake City	Salt Lake County Health Department
VA	Albemarle	Charlottesville	Thomas Jefferson Health District
WA	Snohomish	Everett	Snohomish Health District
WA	King	Seattle	Public Health – Seattle & King County
WI	La Crosse	La Crosse	La Crosse County Health Department

exposures and the sensitivity of the population in each identified jurisdiction. The project team also used qualitative data from the KIIs to measure the existing adaptive capacity in the jurisdiction (see Figure 14 below).

Many state health departments and other government and academic entities have assessed health vulnerabilities to climate change. One example of this is that all 16 states funded by CDC's CRSCI have used local data to inform a climate and health vulnerability assessment or incorporated human health concerns or outcomes into an existing overarching climate vulnerability assessment. However, most cities and counties across the United States have not conducted a climate and health vulnerability assessment, and many do not have health-specific plans for climate-related hazards such as floods and heat waves.^{10,11}

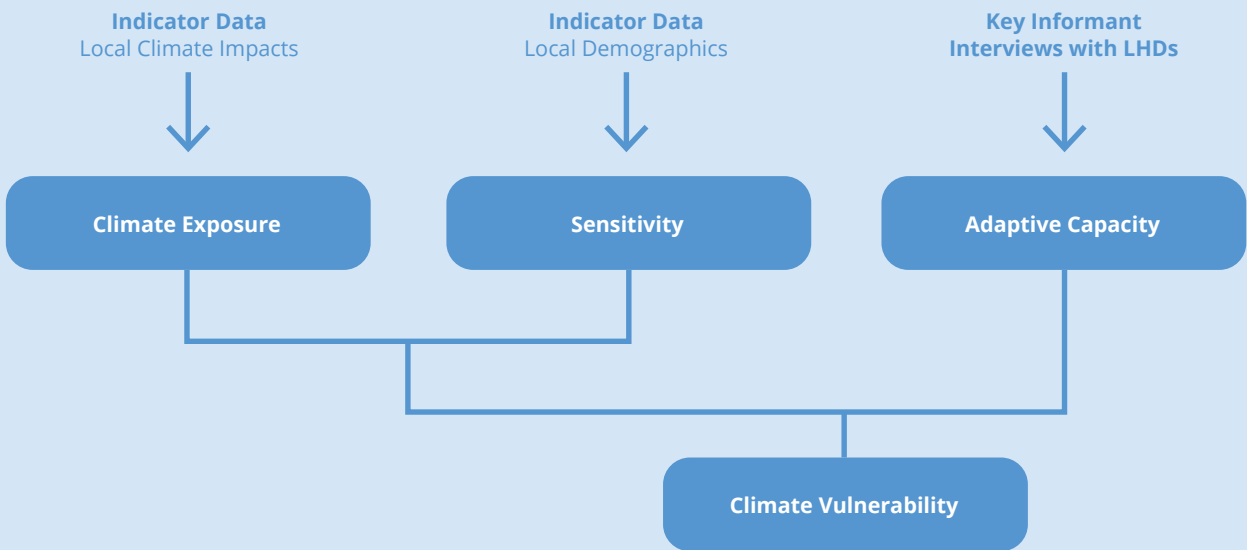
COMPONENTS OF CLIMATE VULNERABILITY ASSESSMENT

As described in Figure 14, this report uses quantitative indicator data combined with qualitative interview



data to assess climate vulnerability of a subset of jurisdictions. This assessment is not a comprehensive picture of vulnerability for each jurisdiction. Full-scale vulnerability assessments often involve collection of local data, intensive input from community members and years of planning that allow for neighborhood-scale decision making. Rather, this assessment

FIGURE 14. COMPONENTS OF CLIMATE VULNERABILITY. ADAPTED FROM CDC'S ASSESSING HEALTH VULNERABILITY TO CLIMATE CHANGE.²²



serves as a snapshot of climate vulnerability based on publicly available jurisdiction-wide level data, with the adaptive capacity component of the assessment being derived by qualitative data from interviews. Combining jurisdiction-wide level data with KII results helps create a comprehensive view of threats, assets and needs of each of the jurisdictions.^j

Adaptive Capacity Definition

As described, the environmental scan involved conducting a climate vulnerability assessment. The project team used information from KIIs to assess adaptive capacity which is a component of climate vulnerability. Adaptive capacity refers to behavioral,

institutional and technological responses and adjustments that lessen the potential impact of climate exposures. One example of adaptive capacity is a neighborhood with strong community ties and active CBOs that may have higher social cohesion to protect against health hazards. Another example is a city with a wildfire communication plan that may be better prepared to respond during a wildfire event by delivering social media messages encouraging people to take actions to protect themselves from smoke exposure. Adaptive capacity is protective and helps to prevent negative health outcomes that arise due to a combination of climate exposure and sensitivities.

TABLE 5. ADAPTIVE CAPACITY SCORING CRITERIA, DEFINITION AND POINTS.

Scoring Criteria	Definition	Points
Funding for climate change	A jurisdiction with funding for climate change that is shown by their implemented climate change projects	2 points
Dedicated staff for climate change programs	A jurisdiction with staff at the LHD dedicated for climate change program	2 points
Having a recent climate action plan	A jurisdiction with a developed climate action	2 points if the jurisdiction climate action plan is from the last 3 years; 1 point if there is a plan, but it is older than 3 years
Conducted or conducting a climate vulnerability assessment	A jurisdiction that has conducted or is conducting a climate vulnerability assessment	2 points if a jurisdiction has conducted a vulnerability assessment; 1 point if they are in the process of conducting an assessment
Having partnerships with CBOs	A jurisdiction with partnerships between LHDs and CBOs for climate change	1 point
Supportive climate groups or networks	A jurisdiction with an active climate change technical committee, network, or both	1 point

^j It should be noted that the term “vulnerability” can have unintentionally negative connotations. All communities have some level of resilience and assets to protect health. Through this assessment, we attempted to capture both the assets and the vulnerabilities within each community.

TABLE 6. ADAPTIVE CAPACITY CATEGORY, AND ITS DEFINITION.

Adaptive Capacity Category	Definition
Low	A jurisdiction with a score less than 4 points
Medium	A jurisdiction with a score between 4 and 5 points
High	A jurisdiction with a score higher than 5

Adaptive Capacity Data Assessment and Results

The project team developed a scale to measure the adaptive capacities of the jurisdictions interviewed. Key themes from the interview data informed the scoring categories. The table below shows the scoring criteria, arranged in order of importance.

Using the interview transcripts, the project team added the points from each scoring criteria together to obtain an overall score for each jurisdiction. The following are the categories for adaptive capacity based on the scoring criteria.

Low adaptive capacity (score less than 4) – 7 jurisdictions

This category describes the health departments that are still developing ideas on how to approach climate change. These LHDs often do not have dedicated human resources for climate change (staff who work on climate change programs exclusively) and lack funding for climate change programs. Additionally, some LHDs do not have a climate change program and climate change is not a high priority for the health department or climate work may be conducted on an ad-hoc basis.

Medium adaptive capacity (score between 4 and 5) – 8 jurisdictions

This category includes LHDs that have plans in place to address climate change and have sought funding for these programs. This category also includes LHDs that have conducted or are conducting climate vulnerability assessments. Most of the jurisdictions in this category have formed partnerships with CBOs or universities to address climate change impacts. LHDs

in this category also have emergency preparedness activities for climate change.

High adaptive capacity (score higher than 5) – 6 jurisdictions

The high adaptive capacity LHDs have fully developed climate action plans, are implementing activities in these plans and regularly update their climate action plan. These LHDs have jurisdiction-wide support for climate change programs and partner with local governmental organizations local NGOs. These LHDs also have climate networks groups or committees within the community, receive funding for their climate programs and often conduct climate change research with local universities. These LHDs also have dedicated staff working on climate change activities and engage with the community in ways that hold the LHDs accountable.

The project team used climate and health indicator data to assess climate exposure and sensitivity for the climate vulnerability assessment. CDC Climate and Health Program staff collected and analyzed demographic and climate impact data to assess local exposure and sensitivity to the health impacts of climate change.

Climate Exposures Definition

The impacts of climate change vary across regions and are heavily dependent on the local environment and climatology. The “Fourth National Climate Assessment” details specific climate impacts in 10 different regions of the United States, and CDC’s “Preparing for the Regional Health Impacts of Climate Change in the United States” discusses location-

specific health impacts of climate exposures in these same regions. Cities in the Southeast, for example, may experience the combined impacts of heat and flooding, which can result in large mosquito populations and potential disease. Coastal communities may experience inundation and coastal flooding, while a city in the desert Southwest will likely face extreme heat events and drought. On an even more local scale, a city may determine that a specific low-lying neighborhood is likely to experience increased flooding. Communities must determine their local climate exposures as a component of their vulnerability assessment. Guiding questions to determining local climate exposures that impact health include:^{3, 23, 24, 25}

- What are the existing climate-related hazards in the community?
- What are the magnitude, frequency, duration and geographic extent of various climate-related exposures that are detrimental to human health?
- What are the trends and what are future projections due to climate change?

Climate Exposure Data Assessment and Results

Data availability is a key factor in determining and quantifying climate exposures. To estimate the level of climate exposure in each of the 21 jurisdictions included in this report, the project team started with an analysis of existing climate and health indicators. The team performed a search for indicators using Google Scholar, received subject matter expert input from CDC's Climate and Health Program staff, and reviewed the webpages of CDC and [Environmental Protection Agency \(EPA\)](#). The team identified 206 potential indicators that have been previously described in publicly available documents. For each of these indicators, the team identified the data source, geographic scope, time scale, and data limitations. The indicator lists and reports assessed were:²⁶

- [CDC Environmental Public Health Tracking Network](#)²⁷
 - 39 potential indicators
- [CSTE](#) "Environmental Health Indicators Collaborative: Climate Change"²⁸



- 14 potential indicators
- [EPA](#) "Climate Change Indicators"²⁶
 - 37 potential indicators
- [The Lancet](#) 2019 "Countdown on Health and Climate Change"²⁹
 - 25 potential indicators
- [United States Global Change Research Program](#) (USGCRP) "Indicators Catalogue"³⁰
 - 14 potential indicators
- [Health Canada](#) "Development of key indicators to quantify the health impacts of climate change on Canadians"³¹
 - 77 potential indicators

The list of 206 indicators was narrowed based on the following factors:

- Relevance to climate impacts at the local level
- Data availability at the required geographic level (city and county)
- Removal of duplicate and overlapping indicators

For example, the team did not include the EPA indicator on arctic sea ice, as it is not directly relevant to local climate impacts in U.S. cities (outside of northern Alaska). The team utilized 12 final indicators: 10 indicators assessing current and historic exposure and two indicators assessing projected future exposure (see Table 5. Overview of climate exposure indicators).³²

With 12 indicators and 21 jurisdictions, there were 253 data points. Of these, only three were missing: ozone data for two jurisdictions and annual PM2.5 for one jurisdiction. For these missing values, the team used the average metric across the jurisdictions.

TABLE 7. OVERVIEW OF CLIMATE EXPOSURE INDICATORS.

Category	Indicator	Data Source	Data Description
Historic Climate Exposures			
Air pollution	2019 Maximum 8-Hour Ozone Concentration	EPA Air Quality Data	Air Quality System ozone data of highest “daily max values” in parts per million of moving average of eight, 1-hour ozone concentrations.
Air pollution	2019 Annual PM _{2.5} Concentration	EPA Air Quality Data	Air Quality System fine particulate matter (PM _{2.5}) data of the arithmetic mean of 24-hour values weighted by 2019 calendar quarter, in micrograms per cubic meter.
Flooding	2011 Number of Housing Units in Flood Hazard Zone Areas	CDC Environmental Public Health Tracking Network	Original data from the Federal Emergency Management Agency (FEMA) 2011 National Flood Hazard Layer.
Flooding	2019 Number of Floods Reported	National Weather Service	Data from Storm Event Database that records 2019 flood occurrences that have sufficient intensity to cause loss of life, injuries, significant property damage and disruption to commerce.
Flooding/storms	2016 Historical Heavy Precipitation Days	CDC Environmental Public Health Tracking Network	Grid-level, modeled North American Land Data Assimilation System (NLDAS) data from the National Aeronautics and Space Administration (NASA) which is then evaluated and processed to create county-level measures of extreme precipitation on the National Tracking Network. ²²
Flooding/storms	2019 Historical Heavy Precipitation Days	CDC Environmental Public Health Tracking Network	Grid-level, modeled NLDAS data from the NASA which is then evaluated and processed to create county-level measures of extreme precipitation on the National Tracking Network. ³³
Heat	2016 Number of Extreme Heat Days	CDC Environmental Public Health Tracking Network	Grid-level, modeled NLDAS data from the NASA which is then evaluated and processed to create county-level measures of extreme heat on the National Tracking Network. ³³
Drought	2019 Annual Average Area Percentage of Drought	U.S. Drought Monitor	Mean of reported 2019 percentages of area with drought (D0 – D4).
Drought	2016 Number of Weeks of Severe or Worst Drought	CDC Environmental Public Health Tracking Network	Utilizes Palmer’s Drought Index.
Wildfire	2019 Number of Wildfires Reported	National Weather Service	Data from Storm Event Database that records 2019 wildfire occurrences that have sufficient intensity to cause loss of life, injuries, significant property damage and disruption to commerce.

Category	Indicator	Data Source	Data Description
Projected Climate Exposure			
Heat	Number of Projected Extreme Heat Days in 2050	CDC Environmental Public Health Tracking Network	Statistical Asynchronous Regional Regression Daily Downscaled Climate Projections: 1/8 degree-CONUS Daily Downscaled Climate Projections.
Flooding/ storms	Number of Projected Extreme Precipitation Days in 2050	CDC Environmental Public Health Tracking Network	Statistical Asynchronous Regional Regression Daily Downscaled Climate Projections: 1/8 degree-CONUS Daily Downscaled Climate Projections.

This introduces some error but prevents the climate hazards in these jurisdictions from being categorically underestimated. The team normalized each metric on a scale from 0-1, with the highest scoring jurisdiction being set at a value of 1. This allowed for the direct combination of all metrics. For historic climate exposures, this resulted in a 0-10 scale when all ten indicators were combined. Scores for historic climate exposure ranged from 2.93 to 5.16, with an average of 3.93. For projected climate exposures, which are based only on heat and precipitation, combining the two indicators resulted in a value ranging from 0 to 2. The highest jurisdiction scored 1.46, the lowest was 0.35, with an average of 1.05.

The project team equally weighted historic and projected exposures and combined them to create a final climate exposure metric for each jurisdiction. Thus, each jurisdiction received a climate hazard value on a scale from 0-10. The highest score for a jurisdiction was 6.04, the lowest was 2.54, with an average of 4.59. The team categorized these values into low, medium and high categories based on observed breaks in the data:

- Low climate hazard (score less than 4)
 - 3 jurisdictions
- Medium climate hazard (score between 4 and 5)
 - 12 jurisdictions
- High climate hazard (score higher than 5)
 - 6 jurisdictions

The final categorization is included in the climate

vulnerability assessment results section of this report.

Sensitivity Definition

Sensitivity encompasses characteristics that determine the ability of a community to withstand climate exposures. There are physiological and socioeconomic factors, like co-morbidities and poverty respectively, that increase the susceptibility of individuals and communities to the climate exposure. The concept of sensitivity also includes access to functioning infrastructure that can influence how people withstand an exposure. For example, a city with high poverty rates and low prevalence of air conditioning may be more sensitive to heat waves. A neighborhood with an aging population and poorly maintained stormwater infrastructure may be more sensitive to flooding events. Communities must determine their local climate sensitivity as a component of their vulnerability assessment. Guiding questions to determining local sensitivities that impact health include:

- What are the demographics of the community?
- Are there education or language factors that may impact the ability of people to access resources?
- What are the trends, and what are future projections due to climate change?

Sensitivity Data Assessment and Results

As with climate hazard data, sensitivity data availability is not uniform. However, the U.S. Census Bureau is a good source for demographic data. We reviewed the NAACP Climate Resilience Indicators, the CDPH

Climate Change & Health Vulnerability Indicators, and CDC's Social Vulnerability Index and developed nine categories of sensitivity indicators. A total of 18 metrics were used to inform these indicators, as outlined in Table 6 below. Because a higher score indicates a higher sensitivity, some data were inverted. For example, having a higher education level is typically protective and leads to better health outcomes. Census data indicating percentage of high

school graduates in the locality were thus inverted. For example, 80 percent would be converted to 20 percent, to represent percentage without a degree. This is indicated in the "data description" section of the table.

Each combined, normalized metric was weighted equally, resulting in a final sensitivity metric on a 0-10 scale. There was no missing data for any of the 378

TABLE 8. OVERVIEW OF CLIMATE SENSITIVITY INDICATORS.

Category	Indicator	Data Source	Data Description
Age	Persons under 5	U.S. Census Bureau	Percent, 2019 estimates
	Persons under 18	U.S. Census Bureau	Percent, 2019 estimates
	Persons 62 and older	U.S. Census Bureau	Percent, 2019 estimates
Ethnicity	Non-Hispanic White	U.S. Census Bureau	Percent, inverted, 2019 estimates
	Black or African American	U.S. Census Bureau	Percent, 50% weight, 2019 estimates
	American Indian and Alaskan Native	U.S. Census Bureau	Percent, 50% weight, 2019 estimates
Foreign Born	Foreign Born	U.S. Census Bureau	Percent, 2014-2018
Housing	Owner-occupied housing units	U.S. Census Bureau	Percent, inverted, 2014-2018
	Medium gross rent	U.S. Census Bureau	(in 2018 dollars) 2014-2018
Language	Language other than English spoken at home	U.S. Census Bureau	Percent of persons age 5 years+, 2014-2018
Education	Bachelor's degree or higher	U.S. Census Bureau	Percent of persons age 25 years+, inverted, 2014-2018
	High school graduate or higher	U.S. Census Bureau	Percent of persons age 25 years+, inverted, 2014-2018
Disability	Person with a disability	U.S. Census Bureau	Under age 65 years, percent, 2014-2018
Insurance	Persons without health insurance	U.S. Census Bureau	Under age 65 years, percent, 2019 estimates
Employment/ Income	Persons in labor force	U.S. Census Bureau	Civilian, percent of population age 16 years+, inverted, 2014-2018
	Medium household income	U.S. Census Bureau	(in 2018 dollars), inverted, 2014-2018
	Per capital income	U.S. Census Bureau	(in 2018 dollars), inverted, 2014-2018
	Persons in poverty	U.S. Census Bureau	Percent, 2019 estimates



data points. Normalization was performed in the same manner as for the climate hazard metrics. For the final sensitivity metric, the highest score was 6.64 and the lowest score was 3.45, with an average score of 4.66. The project team organized these values into low, medium and high categories based on observed breaks in the data and in concordance with the scale of the climate hazard metrics discussed in the previous section:

- Low sensitivity (score less than 4) – 4 jurisdictions
- Medium sensitivity (score between 4 and 5)
 - 12 jurisdictions
- High sensitivity (score higher than 5)
 - 5 jurisdictions

The final categorization is included in the climate vulnerability assessment section and combined with the climate exposure categorizations.

CLIMATE VULNERABILITY ASSESSMENT RESULTS

Combining climate exposures, sensitivity and adaptive capacity results in an overall measure of climate vulnerability. Each factor was assessed on a 0-10 scale, as described in the sections above. Because adaptive capacity is protective (jurisdictions with higher adaptive capacity would be less vulnerable) the adaptive capacity scores were subtracted from 10 before addition into the climate vulnerability

assessment. For example, a jurisdiction receiving a score of 2 in adaptive capacity indicated a low capacity. In the climate vulnerability assessment, this adaptive capacity score of 2 was subtracted from 10 to provide the corrected adaptive capacity score of 8 to be used in the in the climate vulnerability assessment. In this way, all three scores could be combined, resulting in a climate vulnerability metric ranging from 0 to 30. This value was then normalized to arrive at a final climate vulnerability metric on a 0-10 scale, with the most vulnerable jurisdiction set at a value of 10. On this relative scale, the lowest jurisdiction had a value of 5.04. We categorized these into low (less than 6), medium (6 to 8) and high (greater than 8) based on breaks in the data, as described below and in Table 7.

- Low climate vulnerability (score less than 6)
 - 2 jurisdictions
- Medium climate vulnerability (score between 6 and 8) – 7 jurisdictions
- High climate vulnerability (score higher than 8)
 - 12 jurisdictions

These scores are based on an assessment of available data on a select number of indicators which provide a snapshot (not a comprehensive opinion) of these jurisdictions' exposure, sensitivity and capacity.

TABLE 9. SUMMARY OF ALL THE RESULTS FROM THE CLIMATE VULNERABILITY ASSESSMENT FOR 21 URBAN JURISDICTIONS.

Jurisdictions Assessed	Climate Exposure		Sensitivity		Adaptive Capacity		Climate Vulnerability	
	Score	Level	Score	Level	Score	Level	Score	Level
Jurisdiction 1	5.69	High	4.79	Medium	5	Medium	8.50	High
Jurisdiction 2	4.66	Medium	4.56	Medium	5	Medium	7.81	Medium
Jurisdiction 3	5.46	High	4.34	Medium	2	Low	9.78	High
Jurisdiction 4	5.06	High	4.10	Medium	7	High	6.68	Medium
Jurisdiction 5	6.04	High	6.64	High	5	Medium	9.71	High
Jurisdiction 6	4.29	Medium	3.72	Low	6	High	6.59	Medium
Jurisdiction 7	4.62	Medium	4.70	Medium	7	High	6.77	Medium
Jurisdiction 8	3.58	Low	4.46	Medium	8	High	5.52	Low
Jurisdiction 9	4.50	Medium	4.83	Medium	4	Medium	8.42	High
Jurisdiction 10	3.70	Low	3.45	Low	5	Medium	6.67	Medium
Jurisdiction 11	4.77	Medium	4.03	Medium	3	Low	8.68	High
Jurisdiction 12	4.31	Medium	3.88	Low	9	High	5.05	Low
Jurisdiction 13	4.08	Medium	6.43	High	5	Medium	8.52	High
Jurisdiction 14	5.45	High	4.80	Medium	6	High	7.83	Medium
Jurisdiction 15	4.44	Medium	4.03	Medium	3	Low	8.49	High
Jurisdiction 16	4.55	Medium	5.31	High	5	Medium	8.16	High
Jurisdiction 17	5.43	High	5.78	High	3	Low	10.0	High
Jurisdiction 18	2.54	Low	4.99	Medium	4	Medium	7.43	Medium
Jurisdiction 19	4.09	Medium	4.46	Medium	2	Low	9.09	High
Jurisdiction 20	4.89	Medium	5.15	High	2	Low	9.91	High
Jurisdiction 21	4.30	Medium	3.51	Low	3	Low	8.14	High

APPENDIX D: STAKEHOLDER MEETING MATERIALS

*CDC Foundation/The Kresge Foundation
Climate, Health, and Equity Revised Project Proposal
Drafted by CDC Foundation Program Manager
October 18, 2019*

Stakeholder Meeting Purpose and Goal

The goal of the expert stakeholder meeting was to inform strategies in order to conduct a landscape analysis of up to 20 local health departments to address identified needs related to health inequities and the changing climate. The objectives of the meeting were: 1) Discuss how local health departments (LHDs), community-based organizations (CBOs), and other key stakeholders are currently working to prepare and implement strategies to reduce the climate-related health impact within their communities, with a focus on communities who are disproportionately at risk; 2) Learn examples of existing collaborations between LHDs and CBOs; 3) Provide feedback regarding a needs assessment framework and methodology; and 4) Conclude meeting with actionable next steps for the CDC Foundation Program Manager.

Stakeholder Feedback

The 19 stakeholders in attendance were placed in small groups that included a facilitator from the project team. The groups were comprised of stakeholders from differing backgrounds (such as foundations, health department staff, CBO staff, environmental justice and health equity experts) in order to provide a range of perspectives during the discussions. Prior to the small group discussions, the CDC Foundation Program Manager provided an overview of the proposed methodology for selecting health departments to be assessed and for

conducting the needs assessment within the selected health departments.

With regards to health department identification, the stakeholders agreed that the health departments that are selected and prioritized should give a “broad, national picture.” One group recommended that we consider geography, climate impact and community engagement. Another group added that we should consider a continuum of low, medium and high health capacity health departments that are serving in cities that are most impacted by climate hazards. The two other groups provided feedback around equity, but no clear recommendations on how the health departments should be selected and prioritized that would fall within the timeline and scope of the project.

With regards to needs assessment methodology, the stakeholders agreed that a broad variety of activities and partnerships should be prioritized to be assessed, and that we should “look for activities and partnerships that advance multiple goals.” Some examples of health department partnerships to be assessed include emergency management, NGOs, faith communities, local agencies (such as housing, transportation, CBOs, human services, workforce development, planning), academia, environmental justice and civil rights groups. In terms of data collection, stakeholders recommended a balanced of quantitative and qualitative data, including surveys, interviews and focus groups of employees at health

departments, partner agencies and members of the community. One group recommended using the NAACP Climate Resilience Indicators and California Department of Public Health Climate Indicators to assess resilience capacity and needs. Potential stratifications that were recommended include geographic region, experience with equity, city population, climate hazards, demographics, susceptible population, coastal vs. non-coastal, and urban vs. rural.

Revised Proposal

It is proposed that the cities listed in Table 10 be prioritized to participate in the landscape analysis. It is further proposed to make a change in wording from “needs assessment” to “environmental scan.” The environmental scan shall include the following:

- Review of local studies, reports, initiatives, best/promising practices, evidence-based interventions

or current and ongoing programs undertaken by government and nongovernmental organizations (NGOs) to assess climate change impacts

- Review of recent needs assessments that have captured the needs of the vulnerable populations in the area of climate and health
- Review of vulnerability assessments and other data indicators related to climate and health
- Review of state policies related to climate and health
- Survey of health department directors, other health department staff and other cross-sector external stakeholders
- Interviews with willing health department directors, other health department staff and other cross-sector external stakeholders
- Asset mapping of a subset of the cities based on the identified health department categories according to funding

TABLE 10. PROPOSED CITIES.

Cities in CCSI States with no Kresge Funding	Cities with no funding working on climate and health	Cities in CCSI States with Kresge Funding	Cities with no funding with no known climate work	Cities in Non-CCSI States with funding
Chicago, IL	Trenton, NJ	Miami, FL	St. Louis, MO	Atlanta, GA
Baltimore, MD	Salt Lake City, UT	Minneapolis, MN	Memphis, TN	Pittsburgh, PA
Charlotte, NC	Honolulu, HI	Austin, TX	Las Vegas, NV	New Orleans, LA
Providence, RI	Lexington, KY	Portland, OR	Washington, DC	Anchorage, AK
	Akron, OH	Seattle, WA		
	Aspen, CO			
	Houston TX			

CDC Foundation/The Kresge Foundation

Climate, Health, and Equity Expert Stakeholder Meeting | Friday, October 11, 2019

CDC Foundation, Atlanta, GA 30308 | 600 Peachtree Street NE, Suite 1000

TABLE 11: AGENDA.

Topic	Discussion/Decisions	Speaker(s)
Light breakfast		
Welcome	Welcome and Opening Remarks	<p>Brittany Marshall, Program Manager, CDC Foundation</p> <p>Brandon Talley, Vice President for Noninfectious Disease Programs, CDC Foundation</p> <p>Erik Svendsen, Division Director, Division of Environmental Health Science and Practice, CDC</p> <p>Josephine Malilay, Branch Chief, Asthma and Community Health Branch, CDC</p>
Introductions and Housekeeping	<p>Introductions</p> <p>Review Meeting Objectives and Agenda</p> <p>Discuss Rules of Engagement</p>	Brittany Marshall, Program Manager, CDC Foundation
Context Sharing: The Kresge Foundation and CDC Overviews	<p>Provide an overview of The Kresge Foundation Climate, Health, and Equity Programs (15 minutes)</p> <p>Provide an overview of the CDC Climate and Health Program (15 minutes)</p> <p>Q&A</p>	<p>Jalonne White-Newsome, Senior Program Officer, The Kresge Foundation</p> <p>Paul Schramm, Climate Science Team Lead, CDC</p> <p>Shubhayu Saha, Health Scientist, CDC</p>
Break		

Topic	Discussion/Decisions	Speaker(s)
Context Sharing: Expert Stakeholder Lightning Presentations	<p>Lightning presentations from stakeholders to include the following:</p> <ol style="list-style-type: none"> 1) Describe your climate and health work at the local level (provide at least one clear example). 2) How and with whom are you collaborating with on climate and health work? 3) What best practices can you share for conducting climate and health work at the local level? 4) What have been the top three challenges of conducting climate and health work at the local level? 5) What resources would strengthen and/or enhance your ability to conduct climate and health work in your community? 	<p>Linda Helland, Change and Health Equity Program Lead, California Department of Health</p> <p>Carmen Llanes Pulido, Executive Director, Go Austin/Vamos Austin</p> <p>Surili Patel, Deputy Director for the Center for Public Health Policy, APHA</p> <p>Chelsea Gridley-Smith, Director of Environmental Health, NACCHO</p> <p>Matt McKillop, Senior Health Policy Researcher and Analyst, Trust for America's Health</p>
Context Sharing: Proposed Approach and Methodology	<p>Initial results of landscape analysis</p> <p>Proposed approach and methodology</p>	<p>Brittany Marshall, Program Manager, CDC Foundation</p>
Lunch Break and Networking		
Small Group Discussions	<p>Overarching question: What should be included in the needs assessment?</p> <ul style="list-style-type: none"> • What are your initial reactions to the proposed approach for identifying local health departments to participate in the needs assessment? • What local health departments should be prioritized for an invitation to participate in the needs assessment? • What are some potential local activities and partnerships that should be prioritized for the needs assessment? • What are your initial reactions to the proposed methodology for the needs assessment? 	<p>Brittany Marshall, Program Manager, CDC Foundation</p>
Break		
Small Group Discussions (continued)	Report out and group discussion	Expert Stakeholders

Topic	Discussion/Decisions	Speaker(s)
Wrap Up and Next Steps	<p>Were all Parking Lot items addressed?</p> <p>What are the immediate actions and responsible parties?</p> <p>Please submit the evaluation forms!</p>	Brittany Marshall, Program Manager, CDC Foundation

TABLE 12. PARTICIPANTS: CDC FOUNDATION, CDC, AND THE KRESGE FOUNDATION STAFF.

Name	Role	Affiliation
Brittany Marshall	Project Manager	CDC Foundation
Kalisa Hinkle	Program Officer	CDC Foundation
Maria Jolly	Program Officer	CDC Foundation
Paul Schramm	Climate Science Team Lead	CDC
Shubhayu Saha	Senior Health Scientist	CDC
Jalonne White-Newsome	Senior Program Officer, Environment	The Kresge Foundation
Phyllis D. Meadows	Senior Fellow, Health	The Kresge Foundation
Erik Svendsen	Director, Division of Environmental Health Science and Practice	CDC
Josephine Malilay	Branch Chief, Asthma and Community Health	CDC
Brandon Talley	Vice President for Noninfectious Disease Programs	CDC Foundation
Rachna Chandora	Associate Vice President for Noninfectious Disease Programs	CDC Foundation
Carmen Llanes Pulido	Executive Director	Go Austin/Vamos Austin
Sacoby Wilson	University Professor	UMD School of Public Health
Bob Perkowitz	Founder and President	ecoAmerica
Dana Bourland	VP, Environmental Programs	JPB Foundation
Linda Helland	Change and Health Equity Program Lead	California Department of Health
[attendee asked to be unnamed]	[attendee asked to be unnamed]	[attendee asked to be unnamed]

Name	Role	Affiliation
Zelalem Adefris	Resilience Director	Catalyst Miami
Mayra Cruz	Climate Resilience Program Manager	Catalyst Miami
Nathaniel Smith	Executive Director	Partnership for Southern Equity
Surili Patel	Deputy Director for the Center of Public Health Policy	APHA
Chelsea Gridley-Smith	Director of Environmental Health	NACCHO
Natasha DeJarnett	Research Coordinator	NEHA
Matt McKillop	Senior Health Policy Researcher and Analyst	Trust for America's Health
Aileen Daney	Senior Planner, Transportation Access & Mobility Group	Atlanta Regional Commission
Shichen Fan	Planner, Transportation Access & Mobility Group	Atlanta Regional Commission
Jacqueline Patterson	Director of Environmental and Climate Justice	NAACP
Lorraine Cameron	Senior Environmental Epidemiologist, Michigan Climate and Health Adaptation Program	Michigan Department of Health
Iris Gonzalez	Coalition Director	Coalition for Environment, Equity & Resilience (CEER)

SMALL GROUP DISCUSSION QUESTIONS

Round 1: What are your initial reactions to the proposed approach for identifying local health departments to participate in the needs assessment?

1. What barriers or facilitators do you foresee with this proposal?
2. How should health departments be prioritized to be invited to participate in the needs assessment? (possibilities include under-represented geographic areas, leveraging existing capacity in cities with

previous climate and health work, targeting jurisdictions with need but no capacity, etc.)

Round 2: What local health departments should be prioritized for an invitation to participate in the needs assessment?

1. Are you aware of other urban health departments that have received climate and health funding that should be considered?
2. What useful information can be gleaned from the health departments that are in jurisdictions that have multiple streams of climate and health funding?

3. What useful information can be gleaned from the health departments that are in jurisdictions that do not have any streams of climate and health funding?

Round 3: What are some potential local activities and partnerships that should be prioritized for the needs assessment?

1. How and with whom are you collaborating with on climate and health work?

2. What best practices can you share for conducting climate and health work at the local level?

3. What have been the top three challenges of conducting climate and health work at the local level?

4. What resources would strengthen and/or enhance your ability to conduct climate and health work in your community?

5. Are there any climate hazards that we should consider assessing among the jurisdictions?

6. How can equity be included in the process?

Round 4: What are your initial reactions to the proposed methodology for the needs assessment?

1. Of the eight key questions that we currently have, are there other key questions we should aim to answer through the needs assessment? Are there any questions that should be removed?

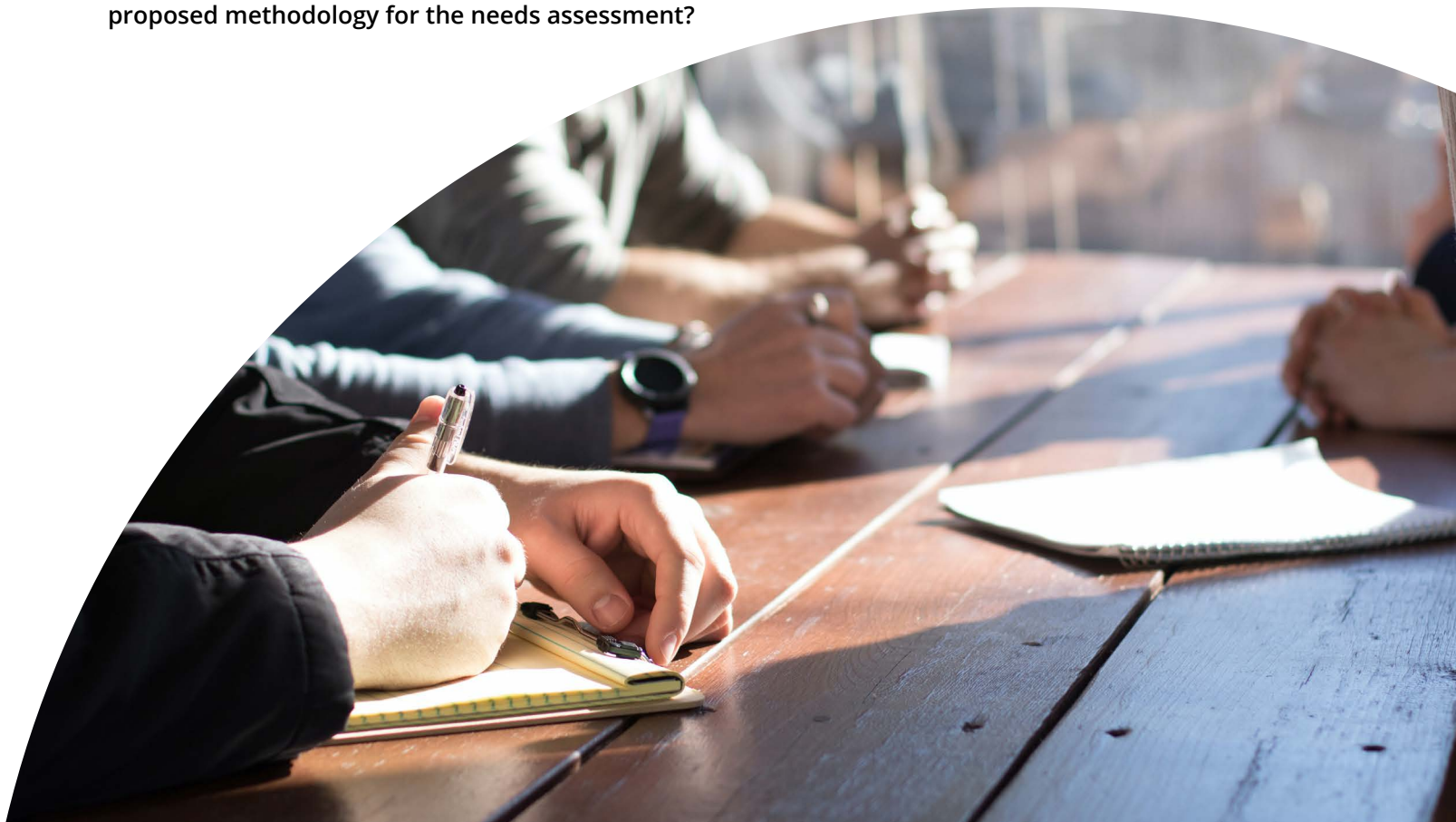
2. How should data be collected? (e.g. Surveys, In-Depth Interviews, Focus Groups)

3. Who should be the target population(s) to participate in the needs assessment? (e.g. HD Directors, community-based organization (CBO) partners within the jurisdictions, other HD staff)

4. How should participants be recruited?

5. What analysis(es) should be used to assess the data?

6. What stratifications, if any, should be utilized to analyze the data? (e.g. HD budget, Geographic region, Population of jurisdiction, Belief that climate change is or is not occurring, BRACE framework – Where are states within the BRACE framework?)



APPENDIX E: RECRUITMENT MATERIALS

From: Program Manager, CDC Foundation

Subject: CDC Foundation Climate, Health, and Equity Project Interview Request

Good morning,

My name is X and I work for the CDC Foundation. I am leading a project in conjunction with The Kresge Foundation and the Centers for Disease Control and Prevention (CDC) Climate Science Team. You may read more about the project via the attachment.

I am reaching out to you to ask if you would be willing to participate in a 30-45-minute interview via Zoom about the climate and health work taking place within your health department and the community-based organizations with whom you collaborate. I am aiming to get a sense of how partnerships between local health departments and community-based organizations are important for addressing community health threats from climate change.

Participation in the interview is completely voluntary. If you decide to participate, you do not have to answer any question that you do not want to answer. What we discuss during the interview will be confidential, meaning no one, will know what we talk about unless you chose to tell them. All interviews will be recorded for analysis purposes, however, findings from the project will be reported in aggregate during a wrap up webinar which you will be invited to attend.

You can sign up for an interview time using the link below. Interviews can be scheduled Monday-Friday based on availability. Once you have signed up, you will receive a confirmation email from CDC Foundation Project Team Member, Eddie Kashinka, with the Zoom link to join the meeting. **To thank you for your participation, participants who complete the follow up interview will receive a \$10 gift card to Starbucks.**

[Link to schedule Interview]

If you have any questions, please let me know. Thank you in advance for your participation. Your feedback and time are greatly appreciated!

Program Manager, CDC Foundation

APPENDIX F: DATA COLLECTION INSTRUMENTS

PRE-INTERVIEW QUESTIONNAIRE

1. Name of Local Health Department (LHD)
2. What are the potential climate changes/impacts that your organization is anticipating in your city? (e.g. flooding, heat waves, extreme weather events, etc.)
3. How would you characterize the climate and health efforts that are currently taking place within your jurisdiction?
 - a. Mitigation
 - b. Adaptation
 - c. Both
 - d. Other
4. Does your LHD currently partner with any community-based organizations (CBOs) for climate work? Yes/No
5. How many partnerships with CBOs does your LHD currently have?
6. On a scale of 1 to 5, overall, how would you rate the strength of your CBO partnerships?
7. Has your health department developed metrics to track the effectiveness of your partnerships in helping your health department reduce the effects of climate impacts? Yes/No
 - a. If yes, please describe the metrics you are using, how long you have been using them, and how they were developed
8. Are there any signs in a reduction of threat to climate hazards as a result of these partnerships? Yes/No
 - a. If yes, please explain
9. Please provide any additional resources that showcase the climate and health work within your LHD and/or jurisdiction that you wish to share (e.g. climate and health webpage, climate action plan, vulnerability assessments, conference presentations, etc.)
10. Please select the date and time that you wish to participate in your key informant interview
(insert link to doodle poll)

KEY INFORMANT INTERVIEW SCRIPT

Interview Questions (HDs with Partnerships)

Hi [insert name], first I want to thank you for taking the time to talk to me. As a reminder, everything we discuss today will be confidential, meaning no one will know what we talk about, unless you choose to tell them. Also, as a reminder,

this interview is voluntary, and you do not have to answer any questions you do not want to answer, and you can stop the interview or ask questions at any time. The interview will be recorded, and I will also be taking notes. When the interview is over, I will write up our discussion verbatim. When I write up your interview, I will not use your name or the names of other people or organizations you might talk about. After the evaluation is over, I will destroy the recording of your interview. Before we get started, do you have any questions?

The first set of questions is to gauge the work that is currently occurring in your city around climate change, health, and equity.

1. Please describe the climate change mitigation and/or adaptation programs/projects do you currently have in place within your city.
 - a. Probe: How long have these activities have occurring in your jurisdiction?
2. Please describe the climate change mitigation and/or adaptation programs/projects do you currently have in place within your health department.
 - a. Probe: How long have these activities have occurring in your jurisdiction?
3. What further steps towards climate change adaptation are planned by your health department or are anticipated to occur in your city in the next two years?
4. What do you see as the most significant facilitator(s) to climate change mitigation and/or adaptation in your city and/or health department?
5. What do you see as the most significant barrier(s) to climate change mitigation and/or adaptation in your city and/or health department?
6. What, if any, other resources do you need in order to advance climate change mitigation and/or adaptation in your city and/or health department?
7. How is your city and/or health department addressing health equity through your climate and health work?

The next set of questions is to get a deeper understanding of how partnerships between local health departments and community-based organizations are important for addressing community health threats from climate change.

8. What role do community-based organizations (CBOs) play in climate change mitigation and/or adaptation in your city?
9. In what ways do CBOs engage with your health department on climate change mitigation and/or adaptation work?
 - a. Probe: Are there any challenges posed by partnerships with CBOs in your climate and health work? If so, please describe.
10. Are there specific ways CBOs have asked you to support their work for climate threats that you have been unable to address?
 - a. Probe: What has kept you from being able to support the CBOs in these efforts?

11. How would you describe the strength of your partnerships with the CBOs in addressing climate change? What would you say are some of the gaps in these partnerships in addressing community health threats from climate change? What would be some of the areas for improvement of these partnerships?
 - a. Probe: Communication, Coordination and Collaboration, Accountability, Duplicated efforts
12. Do the partnerships have a clearly defined scope, terms of reference or MoUs?
13. How would you describe the impact of these partnerships (LHD and CBOs) on climate change?
 - a. Probe: In your opinion, has working together in these partnerships enhanced overall capacity for creativity and innovation in designing programs for climate change?
14. How is your city and/or health department addressing health equity through your partnerships with CBOs?
 - a. Probe: Describe any partnerships developed around any deliberate interventions targeting the vulnerable populations
15. What resources do you need to further support engagement efforts with these CBOs?
16. Is there a specific project you would want to work on to help build a greater capacity and/or partner with CBOs for climate resilience?
17. Is there anything else you wish to share about your climate and health work that we have not covered?

Thank you [insert name], that's all the questions I have for you. What questions do you have for me? I'd like to thank you again for participating in the evaluation. If you do have any questions for me after today, please feel free to send me an email at [insert email] or give me a call at [insert phone number]. Have a great day!

Interview Questions (HDs without Partnerships)

Hi [insert name], first I want to thank you for taking the time to talk to me. As a reminder, everything we discuss today will be confidential, meaning no one will know what we talk about, unless you choose to tell them. Also, as a reminder, this interview is voluntary, and you do not have to answer any questions you do not want to answer, and you can stop the interview or ask questions at any time. The interview will be recorded, and I will also be taking notes. When the interview is over, I will write up our discussion verbatim. When I write up your interview, I will not use your name or the names of other people or organizations you might talk about. After the evaluation is over, I will destroy the recording of your interview. Before we get started, do you have any questions?

The first set of questions is to gauge the work that is currently occurring in your city around climate change, health, and equity.

1. Please describe the climate change mitigation and/or adaptation programs/projects do you currently have in place within your city.
 - a. Probe: How long have these activities have occurring in your jurisdiction?
2. Please describe the climate change mitigation and/or adaptation programs/projects do you currently have in place within your health department.
 - a. Probe: How long have these activities have occurring in your jurisdiction?

3. What further steps towards climate change adaptation are planned by your health department or are anticipated to occur in your city in the next two years?
4. What do you see as the most significant facilitator(s) to climate change mitigation and/or adaptation in your city and/or health department?
5. What do you see as the most significant barrier(s) to climate change mitigation and/or adaptation in your city and/or health department?
6. What, if any, other resources do you need in order to advance climate change mitigation and/or adaptation in your city and/or health department?
7. How is your city and/or health department addressing health equity through your climate and health work?

The next set of questions is to get a deeper understanding of how partnerships between local health departments and community-based organizations are important for addressing community health threats from climate change.

8. What role do community-based organizations (CBOs) play in climate change mitigation and/or adaptation in your city?
9. Why hasn't your health department developed partnerships with CBOs for your climate and health work?
 - a. Probe: What challenges has your health department faced in developing partnerships with CBOs for your climate and health work?
10. Are there specific ways CBOs have asked you to support their work for climate threats that you have been unable to address?
 - a. Probe: [If there are specific ways CBOs have asked them to support them] What ways have they asked for your support?
 - b. Probe: [If there are specific ways CBOs have asked them to support them] What has kept you from being able to support the CBOs in these efforts?
11. What are some potential areas for partnership between your health department and CBOs?
12. How would your health department address health equity specifically through partnerships with CBOs?
13. What resources do you need to further support engagement efforts with CBOs?
14. Is there a specific project you would want to work on to partner with CBOs for climate resilience?
15. Is there anything else you wish to share about your climate and health work that we have not covered?

Thank you [insert name], that's all the questions I have for you. What questions do you have for me? I'd like to thank you again for participating in the evaluation. If you do have any questions for me after today, please feel free to send me an email at [insert email] or give me a call at [insert phone number]. Have a great day!

APPENDIX G: REFERENCES

- 1 Crimmins A., Balbus J., Gamble J.L., et.al. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. U.S Global Change Research Program. Washington, DC. 2016. <http://dx.doi.org/10.7930/J0R49NQX>
- 2 Climate and Health Program, Centers for Disease Control and Prevention. Impact of Climate Change on Health. February 2011. cdc.gov/climateandhealth/effects/default.htm
- 3 Climate and Health Program, Centers for Disease Control and Prevention. Preparing for the Regional Health Impacts of Climate Change. July 2020. cdc.gov/climateandhealth/docs/Health_Impacts_Climate_Change-508_final.pdf
- 4 The City Of New York, Cool Neighborhoods NYC: A Comprehensive Approach to Keep Communities Safe in Extreme Heat. New York City, New York. 2017. https://www1.nyc.gov/assets/orr/pdf/Cool_Neighborhoods_NYC_Report.pdf
- 5 Gold J. Northeast Regional Heat Collaborative: Lowering Our Heat Advisory Threshold to Protect Public Health. May 2017. http://www.nrcc.cornell.edu/workshops/webinars/2017/05/present_2.pdf
- 6 Rudolph L., Harrison C., Buckley L., et.al. Climate Change, Health, and Equity: A Guide for Local Health Departments. Oakland, CA and Washington D.C., Public Health Institute and American Public Health Association. 2018. apha.org/topics-and-issues/climate-change/guide
- 7 Climate and Health Program, Centers for Disease Control and Prevention. Climate and Health: A Guide for Cross-Sector Collaboration. cdc.gov/climateandhealth/docs/CrossSectorClimateandHealth.pdf
- 8 National Association of County and City Health Officials. Directory of Local Health Departments. naccho.org/membership/lhd-directory?searchType=standard&lhd-state=RI#card-filter
- 9 Albright K., Shah P., Santodomingo M., et.al. Dissemination of Information About Climate Change by State and Local Public Health Departments: United States, 2019–2020. American Journal of Public Health. April 2020. <https://doi.org/10.2105/AJPH.2020.305723>
- 10 Balbus J., Ebi K., Finzer L., et.al. Are We Ready? Preparing for the public health challenges of climate change. Environmental Defense Fund. 2008. edf.org/sites/default/files/7846_AreWeReady_April2008.pdf
- 11 National Association of County and City Health Officials. Are We Ready? Report 2: PREPARING FOR THE PUBLIC HEALTH CHALLENGES OF CLIMATE CHANGE. 2014. naccho.org/uploads/downloadable-resources/NA609PDF-AreWeReady2.pdf
- 12 Public Health Institute. Climate Change, Health and Equity. American Public Health Association. 2018. apha.org/topics-and-issues/climate-change/guide
- 13 Bay Area Regional Health Inequities Initiative. Local Health Departments and Subject Matter Experts Address Climate Change Readiness in California: Findings and Recommendations. 2018.
- 14 Grossman E., Hathaway M., Bush K.F., et al. Minigrants to Local Health Departments: An Opportunity to Promote Climate Change Preparedness. Journal of Public Health Management and Practice. 2019. <https://pubmed.ncbi.nlm.nih.gov/29927899/>
- 15 California Department of Public Health. Implementation and Monitoring Strategy (IMS) for Resilience to Multiple Exposures: Local Health Departments (LHDs) Utilize CalBRACE Resources to Develop Local Plans for Building Resilience to Climate Change Effects V3.0. 2019.
- 16 National Association of County and City Health Officials. Global Climate Change Workgroup Roster. August 2018. naccho.org/uploads/downloadable-resources/CC-Workgroup-Roster-2018-2019.pdf

- 17 National Association of County and City Health Officials. Essential Actions for Climate Resilience in Local Health Departments. June 2018. naccho.org/uploads/downloadable-resources/Essential-Actions-for-Climate-Resilience-Fact-Sheet.pdf
- 18 Climate and Health Program, Centers for Disease Control and Prevention. Resources for Public Health Professionals. September 2019. cdc.gov/climateandhealth/site_resources.htm
- 19 Climate and Health Program, Centers for Disease Control and Prevention. CDC's Building Resilience Against Climate Effects (BRACE) Framework. September 2019. cdc.gov/climateandhealth/BRACE.htm
- 20 Grosseohme D. Overview of Qualitative Research. Journal of Health Care Chaplaincy. June 2014.
- 21 Bernard R. Research Methods in Anthropology: Qualitative and Quantitative Approaches. Oxford: UK. 2011. worldcat.org/title/research-methods-in-anthropology-qualitative-and-quantitative-approaches/oclc/720398213
- 22 Manangan A.P., Uejio C.K., Saha S., et al. Assessing Health Vulnerability to Climate Change: A Guide for Health Departments. cdc.gov/climateandhealth/docs/AssessingHealthVulnerabilitytoClimateChange_508.pdf
- 23 Reidmiller D.R., Avery C.W., Easterling D.R., et al. Impacts, Risks, and Adaptation in the United States: The Fourth National Climate Assessment, Volume II. U.S. Global Change Research Program. 2018. <https://nca2018.globalchange.gov/>
- 24 Runkle J., Svendsen E.R., Hamann M., et al. Population Health Adaptation Approaches to the Increasing Severity and Frequency of Weather-Related Disasters Resulting From our Changing Climate: A Literature Review and Application to Charleston, South Carolina. Current Environmental Health Reports. 2018. <https://pubmed.ncbi.nlm.nih.gov/30406894/>
- 25 Maricopa County Department of Public Health. Climate and Health Strategic Plan for Maricopa County 2016-2021. 2018. maricopa.gov/DocumentCenter/View/38688/Climate-and-Health-Strategic-Plan-2016-2021-PDF
- 26 United States Environmental Protection Agency. Climate Change Indicators in the United States. epa.gov/climate-indicators
- 27 National Environmental Public Health Tracking Network, Centers for Disease Control and Prevention. <https://ephtracking.cdc.gov/showHome>
- 28 Council for State and Territorial Epidemiologists. ENVIRONMENTAL HEALTH INDICATORS: CLIMATE CHANGE. <https://www.cste.org/page/EHIndicatorsClimate>
- 29 The Lancet Countdown. The Lancet. thelancet.com/action/showPdf?pii=S0140-6736%2819%2932596-6
- 30 United States Global Change Research Program. USGCRP Indicators Catalog. globalchange.gov/browse/indicators/catalog
- 31 Cheng J.J., Berry P. Development of key indicators to quantify the health impacts of climate change on Canadians. International Journal on Public Health. July 2013. <https://link.springer.com/content/pdf/10.1007%2Fs00038-013-0499-5.pdf>
- 32 United States Environmental Protection Agency. Climate Change Indicators: Arctic Sea Ice. epa.gov/climate-indicators/climate-change-indicators-arctic-sea-ice
- 33 North American Land Data Assimilation (NLDAS). National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration. emc.ncep.noaa.gov/mmb/nldas



THE KRESGE FOUNDATION