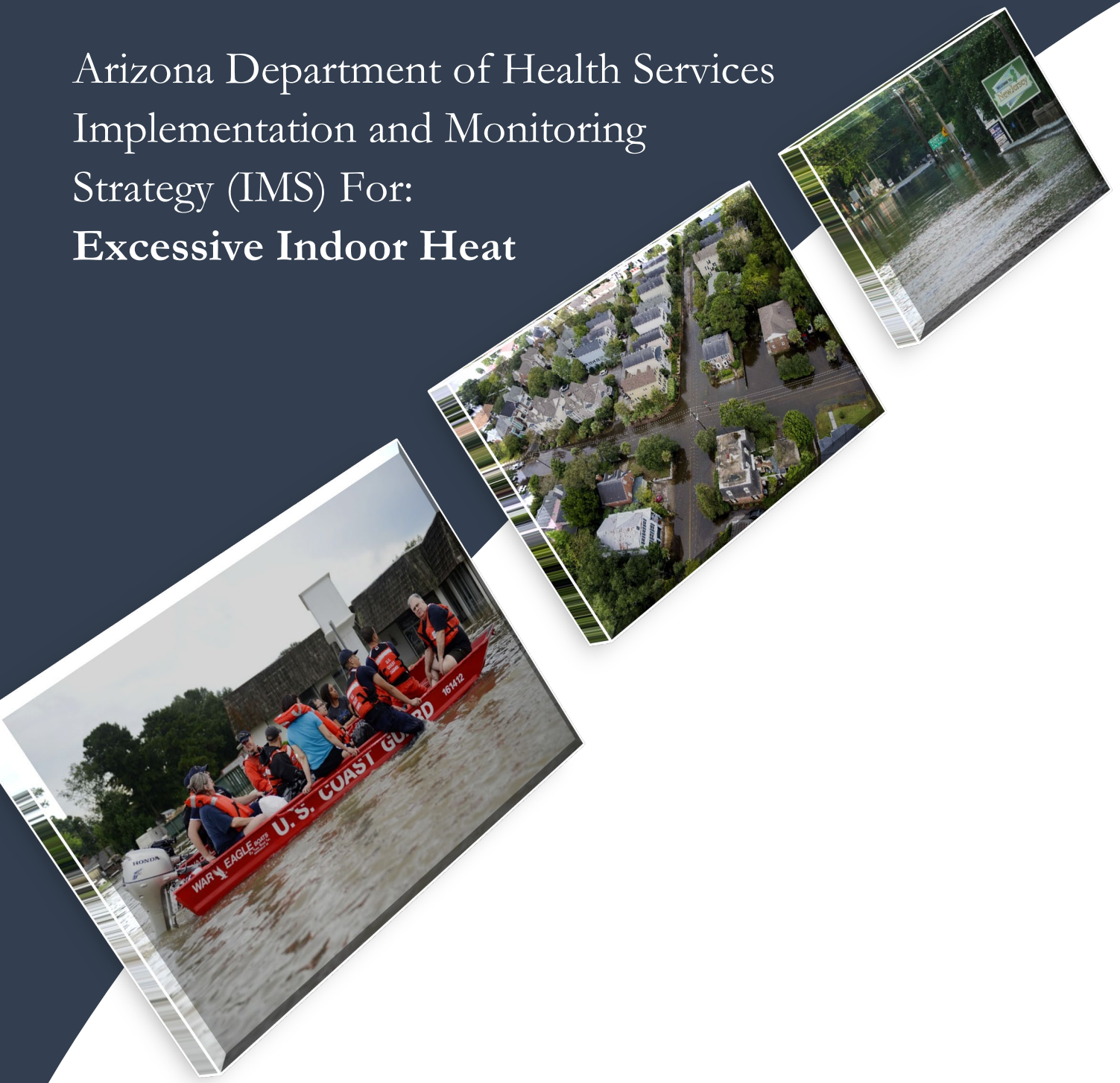
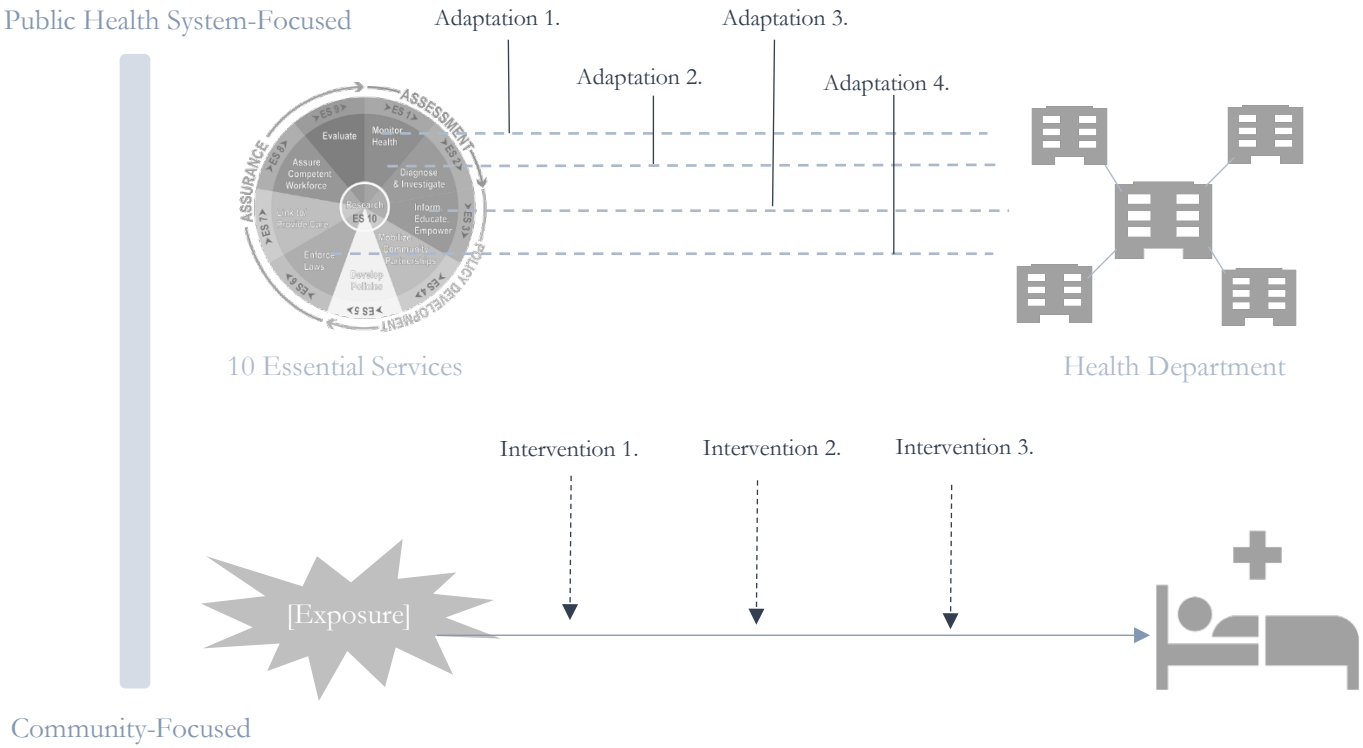
Arizona Department of Health Services Implementation and Monitoring Strategy (IMS) For: **Excessive Indoor Heat**



This IMS is a living document. It outlines a plan of action for the [health department] to implement adaptations and interventions aimed at disrupting the pathway between [exposure] and its subsequent health outcomes. Interventions and adaptations described throughout this IMS were deemed suitable through previous steps of BRACE (Steps 3 and 4) as well as through engagement with stakeholders to the adaptations and interventions. This plan of action requires a description of how each adaptation and intervention will be implemented, communicated, and evaluated. An initial, completed IMS for all selected exposure foci will satisfy performance measures A through H of the CDC-RFA-EH16-1602. Updates to all IMSes over time will satisfy performance measure K of the CDC-RFA-EH16-1602.

Selected Exposure-Response Adaptations and Interventions

Exposure – Response Pathway



Adaptation 1. [The name of the in-house action that…]

Description of Adaptation or Intervention

In Arizona, a significant portion of heat-related deaths are associated with indoor exposure, but there are no explicit public programs or systems designed to detect extreme heat indoors and trigger appropriate community actions in a timely manner. We propose to use real-time indoor sensors to build a peer-to-peer knowledge-sharing platform that would alert individuals when dangerously hot conditions are measured inside one's home that would trigger a wellness check by a neighbor, family member, friend, or other support personnel. Prototypes of this intervention have been favorably reviewed by staff in multiple city governments and with selected groups of county residents, and yielded important questions and challenges that could be investigated under the auspices of the CHAMP program. In particular, finding ways to align real-time emergency response to extreme indoor heat with the network of community resources for energy assistance and weatherization is a critical need. We already understand, from previous pilot tests, that the necessary software and hardware components to operate such a system are readily available.

The following are the three primary activities associated with the implementation of this adaptation.

1) Installation and Monitoring
    a) Design the survey and interview questions and protocol
    b) Assemble the temperature sensor and instruction kits for residents
    c) Recruit residents to participate in the intervention
    d) Deploy temperature sensors, survey, and interview

2) Data Analysis
    a) Analyze the temperature sensor, survey, and interview data

3) Disseminate Results
    a) Produce participant and stakeholder reports, presentations, and academic publication

Site locations

The activities and outcomes of this intervention will occur in the homes of residents in Maricopa, Yuma, Mohave, and Pinal counties. Due to the on-going COVID-19 pandemic, participating residents will receive indoor temperature sensor kits delivered through the mail. Each kit will be assembled by team members in-person at Arizona State University and contain the temperature sensors, a set of instructions to set up the sensor, and pamphlets containing information on how to spot and respond to heat-related illness and relevant services (e.g. weatherization rebates, utility assistance, and cooling center locations). The team members from the Arizona Department of Health Services and university partners will be in contact with residents via email and/or phone to assist with sensor installation. Additionally, the team members will also conduct a short survey/interview with residents at the beginning, middle, and end of the study to gather data on residents' risk perceptions and use of the intervention. The survey/interviews will be conducted over the phone. The team members will work together virtually to develop the survey and interview protocols. The analysis of the survey, interview, and temperature data will be

completed virtually by team members from partnering Arizona State University. The results of the project will be either mailed or emailed to the participants and stakeholders. The results will also be presented at the annual State Heat Safety Meeting and hosted on the Arizona Department of Health Services Extreme Weather and Public Health webpage.

Methodology

This intervention will be based on two primary sources of data: temperature sensors and survey/semi-structured interviews. In addition to air temperature and humidity the temperature sensors also collect data on the number notifications sent to residents and care-givers. If the indoor temperature reaches a specific threshold temperature then alert notifications will be sent to residents and caregivers. The alerts will prompt residents to take action to either reduce the temperature of their home and/or get somewhere cooler. In either case the short term goal is to lower the resident's exposure by notifying them when their exposure is too high and connecting them with other persons who could help if need be. Through the survey and interview we will collect information on general demographics, adaptive behaviors/resources, and perception of risk to extreme heat. The interview will focus on the residents' and caregivers' perceptions of the temperature alerts with a focus on understanding the effectiveness of the alerts to reduce exposure and identify potential barriers to their use. All of the evaluation instruments will be reviewed and approved by the human subjects Institutional Review Board at Arizona State University prior to deployment. All team members will be certified through the CITI program, where necessary, to conduct human subjects research in compliance with ethical guidelines and institutional standards. We will also test the sensors, survey, and interview protocols among team members prior to sending the kits to participating residents.

Local Data

All of the data used in this intervention will be collected locally and result in three separate datasets; a survey, interview, and temperature sensor. The temperature and sensor alert data will be collected using wifi enabled Tempstick and/or the 4G enabled MarCELL multisensors. These sensors both enable alerts to be sent to residents and relevant caretakers to alert them when the resident's indoor temperature becomes dangerously high. The research team will develop a survey which will collect information about respondents' sociodemographic status, adaptive resources and behaviors, social network (friends, family, neighbors, etc), and perception of their risk of experiencing heat-related symptoms. The interview will be conducted toward the end of the study period and will complement the survey by allowing the respondents to speak at length about their experience with the intervention in order to assess how the changes in their behavior, risk perception reduced their risk of experiencing heat-related illness. The interview will also help identify any concerns or problems associated with the intervention.

Stakeholder and Team Roster and Responsibilities

Team Roster

- Project admin/guidance - Matt Roach - Arizona Department of Health Services
- Project management - David Hondula - Arizona State University
- Research coordinator - Lance Watkins - Arizona State University
- Research support - Carmen Tirdea - Arizona Department of Health Services

Stakeholder roster

- Maricopa Bridging Climate Change and Public Health (BCCPH)
- Foundation for Senior Living - Carrie Smith - recruit study participants
- Yuma County
- Pinal County
- Mohave County
- Advisory group/partners
    - Salt River Project (SRP) - contact
    - Arizona Public Service (APS) - contact
    - AZ Forward - contact
    - Vitalyst Health Foundation - CJ Hager, Jon Ford
    - Maricopa County Department of Public Health (MCDPH) - Vjollca Berisha
    - City of Tempe - Braden Kay
    - City of Phoenix - Mark Hartman
    - City of Mesa - contact

Timeline with Milestones and Deadlines

- March, 2021
    - Determine jurisdiction(s) for pilot study
    - Finalize IRB
    - Sensor testing and calibration
- April, 2021
    - Identify participating households
    - Sampling procedure based on indicators and/or stakeholder - community connections
    - Develop household delivery/instruction kits
- May, 2021
    - Conduct informational interview with households, establish peer response networks
    - Conduct informational interviews + training with peer response networks
    - Conduct training with households, deliver/install sensors
- July, 2021
    - Conduct mid-season equipment checks and interviews with households and response networks
    - Adjust response networks and thresholds/protocol as needed
- August, 2021
    - Preliminary Analysis (August 2021) - exploratory analysis

    - Number alarms sent, variation in indoor temperatures, examine change in temperature before and after an alarm, relate the number of alarms and/or before/after change in temperature to survey questions.
- October, 2021
    - Conduct end of season interviews with households and response networks
    - Retrieve sensors, download data
    - Issue compensation
- October, 2021 - January, 2022
    - Analyze interview responses - content analysis
    - Analyze temperature data and alert records
- February, 2022
    - Hold stakeholder workshop to present results
- March, 2022
    - Deliver final report to participants, submit academic manuscript

Needed Resources

Equipment

- Budget for 10-20 additional TempSticks or other 30-40 MarCELL sensors.
- Budget for participant compensation for 20-40 participants
- Budget for logistical partners (provide help with recruitment and coordination
- Budget for advisory partners (help with interpretation of results, planning for future iterations of the intervention)

Human capital

- Participating households

Funding

Objective

The objective of the communication strategy is to communicate the effectiveness of personal indoor temperature sensors to help reduce the risk associated with extreme heat in homes.

Activities

1. Annual Heat Meeting - April 19, 2021
    a. Description: Present the project to the broader heat community in AZ
    b. Stakeholders: Arizona Department of Health Services, Arizona State University, Foundation for Senior Living, project advisory group
    c. Target Audience: from academia, businesses, elected officials, emergency management, government, media, non-profit, tribes, public safety, and meteorology
    d. Timeline: April 19, 2021
    e. Number and description of all materials used: 1 presentation outlining the project.

2. Participant recruitment flyers/e-mails
    a. Description: We will be using a combination of flyers and e-mail communication to recruit participants for this study.
    b. Stakeholders: Arizona Department of Health Services, Arizona State University, Foundation for Senior Living
    c. Target Audience: Arizona residents who are most at risk of experiencing symptoms of heat related illness due to high temperatures in their homes. This includes elderly, elderly living alone, and homebound individuals.
    d. Timeline: April 2021
    e. Number and description of all materials used: About 3 meetings with partnering organizations (to outline the recruitment process), send recruitment email and/or flyer to with residents who qualify to participate in the study.

3. Deployment of instructions for participants
    a. Description: tempsticks,
    b. Stakeholders: Arizona Department of Health Services, Arizona State University, Foundation for Senior Living
    c. Target Audience: Residents who have agreed to participate in the study.
    d. Timeline: May 2021
    e. Number and description of all materials used:

4. Final report to participants/Stakeholders
    a. Description: This will be something like an infographic/flyer that each participant will receive that summarizes their results of the study. The report can also contain a list of resources that can help them address extreme heat (weatherization programs, general info about symptoms of heat illness, energy rebates, etcs). An overall summary will be sent to stakeholders.
    b. Stakeholders: Arizona Department of Health Services, Arizona State University, Foundation for Senior Living
    c. Target audience: Study Participants, Arizona Department of Health Services, Arizona State University
    d. Timeline: August 2021 (Preliminary results); March 2022 (Final results)

e. Number and description of all materials used: 30-40 infographic/flyers will be sent to participants. An overall report will be sent to each stakeholder (1-5)

5. Workshop for professional stakeholders
    a. Description: The final results of the study will be presented at the AZ Extreme Heat and Planning Workshop, which brings together stakeholders from a variety of different sectors to share ongoing and future efforts to address extreme heat in the state.
    b. Stakeholders: Arizona Department of Health Services, Arizona State University, Foundation for Senior Living,
    c. Target audience: from academia, businesses, elected officials, emergency management, government, media, non-profit, tribes, public safety, and meteorology
    d. Timeline: February 2022
    e. Number and description of all materials used: 1 PowerPoint presentation

6. Academic manuscript
    a. Description: An academic publication of this study.
    b. Stakeholders: Arizona State University, Arizona Department of Health Services
    c. Target audience: academia, government, media
    d. Timeline: March 2022
    e. Number and description of all materials used:

Evaluation Purpose

Determine if broader use of real-time indoor temperature sensors are an effective public health intervention for reducing incidence of heat-related illness in Arizona. The success of this intervention will be used to inform future interventions and scale this intervention more broadly. The evaluation findings will also enable us to adjust the intervention and address challenges that recipients of the temperature sensors reported. Additionally, the feedback from recipients' caregiving network could be useful in identifying potential partners for long-term/institutionalized support.

Table #. Stakeholder Engagement

Stakeholder name or group	Stakeholder category	Interest of perspective	Role in evaluation
[Individuals or groups who have an interest in the evaluation of this adaptation or intervention]	[Stakeholders are characterized here is either: 1. Primary, meaning they are the most invested and affected by the evaluation findings, 2. Secondary meaning they are either invested but not as affected by the findings, or affected by, but not as invested in, the findings, or 3. Tertiary meaning they are invested or affected but to lesser degrees than those listed in the previous two categories.]	[What perspective of the evaluation are they most interested in? For example, are they interested in the evaluation from a cost angle, effectiveness of the program, a critic, etc.?]	[What role will the listed individual or group play in developing or implementing this evaluation plan? Examples include serving on planning team or as external reviewer, collecting data, interpreting findings, receiving results.]
Maricopa Bridging Climate Change and Public Health (MBCCPH)	Primary	They are interested in the effectiveness of the intervention as a means of reducing risk associated with extreme heat	MBCCPH will help with receiving the results, assist in interpreting the findings, and contribute to broader discussions regarding the effectiveness of the intervention.
Maricopa County Department of Public Health (MCDPH)	Primary	They are interested in the effectiveness of the intervention as a means of reducing risk associated with extreme heat	MCDPH will help with receiving the results, assist in interpreting the findings, and contribute to broader discussions regarding the effectiveness of the intervention.
Foundation for Senior Living	Secondary	They are interested in the effectiveness	FSL will help facilitate communication of the

		of the intervention as a means of reducing risk associated with extreme heat	effectiveness of the intervention to participants.
City of Tempe	Secondary	They are interested in the effectiveness of the intervention as a means of reducing risk associated with extreme heat	The city of Tempe will receive the results and contribute to broader discussions regarding the effectiveness of the intervention.
City of Phoenix	Secondary	They are interested in the effectiveness of the intervention as a means of reducing risk associated with extreme heat	The city of Phoenix will receive the results and take part in future discussions regarding the effectiveness of the intervention
City of Mesa	Secondary	They are interested in the effectiveness of the intervention as a means of reducing risk associated with extreme heat	The city of Mesa will receive the results and take part in future discussions regarding the effectiveness of the intervention
Vitalyst Health Foundation	Tertiary	They are interested in the effectiveness of the intervention as a means of reducing risk associated with extreme heat	They will receive the results and take part in future discussions regarding the effectiveness of the intervention
AZ Forward	Tertiary	They are interested in the effectiveness of the intervention as a means of reducing risk associated with extreme heat	They will receive the results
Salt River Project (SRP)	Tertiary	They are interested in the effectiveness of the intervention as a means of reducing risk associated with extreme heat	They will receive the results
Arizona Public Service (APS)	Tertiary	They are interested in the effectiveness of the intervention	They will receive the results

	as a means of reducing risk associated with extreme heat

Cultural competence (if applicable)

This intervention could be particularly helpful in reducing heat risk for those who are homebound and/or the elderly, which represent some of the populations most vulnerable to extreme heat. We acknowledge that we have a limited understanding of the specific perspectives and concerns that those who are a part of these groups might have. We will be working closely with the Foundation for Senior Living to help facilitate interactions and ensure that we are able to fully incorporate the needs and perspectives of these populations.

Need

According to the Maricopa County Public Health department, which services the most populous county in the state, nearly a quarter of heat related deaths in 2019 occurred indoors. Of the deaths that occurred indoors, 63% occurred in a home or apartment. Despite the vast majority of indoor deaths occurring in an environment with an A/C unit the indoor environments were still dangerously hot. Some of the reasons A/C units were not used was due to A/C unity malfunctions, lack of electricity, limited use due to the cost, forgetfulness, and/or the AC unit being set to a high temperature. While there has been a focus on addressing the risk of extreme heat in Maricopa County there currently doesn't exist an intervention that specifically addresses indoor heat deaths. The intervention we propose would directly address this need by providing an opportunity to alert residents and those close to them when their home is dangerously hot and prompt them to take action to reduce exposure.

Context

[What is the adaptation's, or intervention's, context? What contextual factors may affect its implementation or effectiveness? May be derived from previous BRACE work.]

Mohave, Maricopa, Pima, and Yuma counties all reside within hot-desert climates of the Mohave and Sonoran deserts and regularly experience temperatures in excess of 100 degrees throughout the summer months of June - August. In the summer of 2019, Yuma experienced 89 and 87 days above 95°F and 100°F respectively; while Maricopa County experienced 92 and 86 days above 95°F above 100°F. Extreme heat remains a threat to public health. In 2019, there were a total of 1545, 136, and 231 heat-related emergency room visits that occurred in Maricopa, Mohave, and Yuma counties, respectively. The majority of governmental efforts to address extreme heat focus on physical changes to the outdoor landscape (e.g. increasing tree canopy coverage along pedestrian paths). However, relatively few interventions have been implemented in this study area to specifically address the threat of indoor extreme heat exposure. The intervention we have proposed aims to reduce the risk of experiencing heat-related illness and/or death due to indoor heat exposure.

Population addressed

Working in collaboration with our stakeholders, we intend to target those most at risk of experiencing heat-related illness indoors, which include homebound populations, the elderly, and/or low income households, and those living alone.

Logic model

[This first table serves to organize all the elements of the adaptation or intervention. The "Resources/Inputs" and "Activities" columns should be populated with content from your Implementation Component for this adaptation or intervention. Outcomes may have been previously mentioned or described in the Implementation Component, but will likely be described in detail here for the first time.]

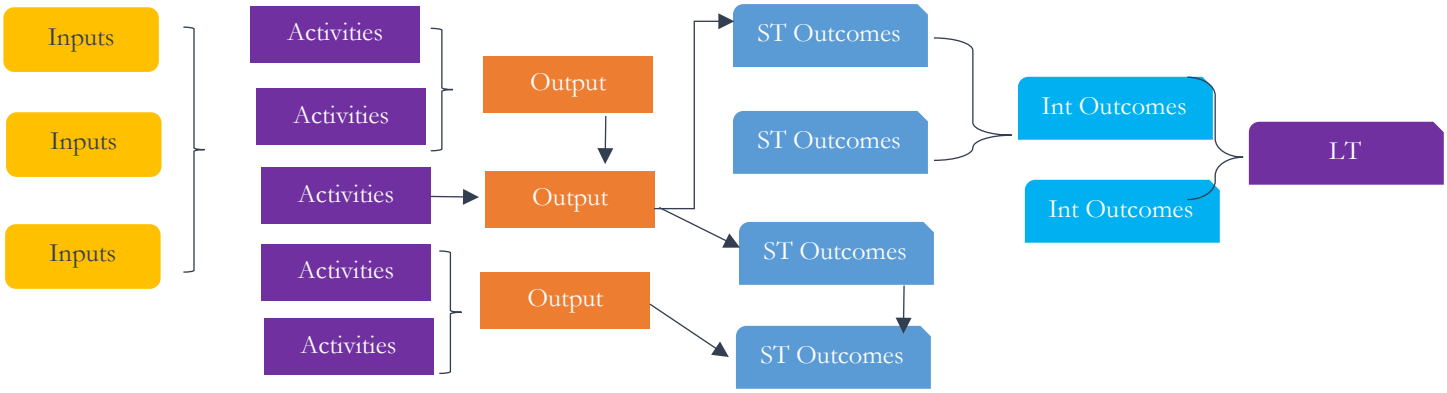
Table [#]. [Adaptation or Intervention] Description Table

Resources/Inputs	Activities		Outputs	Outcomes		
	Initial	Subsequent		Short-Term	Intermediate	Long-term
Previous heat-related surveys and interviews, research protocols	Recruitment, development	Installation and monitoring	Interview responses, temperature dataset, record of alerts and actions	More people are using personal temperature sensors, increased awareness of the risk of extreme heat, increase knowledge of symptoms of heat-related illness	More people are using personal temperature sensors, increased awareness of the risk of extreme heat, increase knowledge of symptoms of heat-related illness,	Documentation of the protocol for installing and monitoring indoor temperature alerts, which could be adapted if this project is scaled up and implemented by other municipalities.
Temperature sensors, team member expertise, previous code,	Retrieve data	Data Analysis	Project results identifying the usefulness of the intervention, identifying influence of risk perception, sensitivities, and adaptive behaviors on	Improved understanding of the risk of extreme heat among participants, identifying specific protective behaviors that were engaged in after alerts were sent,	Promote protective behaviors that participants cite as useful for reducing heat exposure after the	Reduction in heat-related morbidity and mortality, identify potential adaptive behaviors/resources that municipalities could prioritize institutional support for (e.g. programs designed to help low-income households

			overall indoor heat risk, identify different caregiving networks and the interactions between resident and caregiving network that result in protective action when temperature alert is triggered	identify barriers to participant use of the in home temperature sensors, assess the effectiveness of the intervention	alert was sent.	weatherize their homes, which would reduce heat exposure,
Results of data analysis	Disseminate Results	Address questions that may arise	Increased conversation about the risk of indoor heat and potential for future collaborations among stakeholders to address indoor heat.	Enhance institutional and stakeholder awareness of the risk of indoor heat exposure, increase awareness of this intervention as one way to reduce the risk of indoor heat.	Interest in adapting this intervention in other communities across Arizona.	Encourage continued conversation and collaboration between stakeholders on long term policy changes that could support this and other interventions to reduce the risk of indoor heat, plan for future efforts to enhance/expand this intervention.

Figure [#]. [Adaptation or Intervention] Logic Model

[This is a diagram that shows the pathways between certain activities, their outputs and their subsequent (ST = short-term, Int= intermediate, LT=long-term) outcomes. The colors and number of elements below are simply to show an example of what a final figure could look like. Each adaptation or intervention will have different arrangement of the elements below, and can be represented by different symbols or colors than those shown below.]



Evaluation Questions and Indicators

[What questions do you plan to be able to answer during, or sometime after, the implementation of this adaptation or intervention? Do the questions align with the Good Evaluation Questions Checklist? *(http://www.cdc.gov/asthma/program_eval/AssessingEvaluationQuestionChecklist.pdf.)*]

Evaluation Question	Indicator	Standards (What Constitutes "Success"?)
1. Are indoor temperature alerts useful in reducing risk of experiencing dangerously high temperatures indoors at home?	Interview data	Complete set of interviews collected and of sufficient quality for data analysis
	Survey data	Complete set of surveys collected
	Temperature sensor data	Complete set of temperature data collected
	Data analysis	Report of final results
2. How helpful is it to have someone in a resident's care network notified that their home is dangerously hot?	Interview data	Complete set of interviews collected and of sufficient quality for data analysis
	Survey data	Complete set of surveys collected
	Data analysis	Report of final results
3. What were any difficulties in implementing this intervention?	Interview data	Complete set of interviews collected and of sufficient quality for data analysis
	Survey data	Complete set of surveys collected
	Data analysis	Report of final results

Data Collection Table (Methods)

Evaluation Question [Copied from above]	Indicator [What is/are the unit(s) of measurement that will answer the evaluation question]	Data collection method [How will data be obtained on this indicator]	Source of data [From where will data be obtained?]	Frequency of data collection	Person responsible for collection	Due Date
Are indoor temperature alerts useful in reducing risk of experiencing dangerously high temperatures indoors at home?	Interview data (thematic analysis of actions taken when alerts were issued)	Phone interview	Primary data collected by project team	Once	Project Team	
	Survey data (Perceived risk of heat-health dangers and ability to cope)	Qualtrics survey	Primary data collected by project team	Three times	Project Team	
	Temperature data (% of time above threshold temp	TempStick	Primary data collected by project team	Continuously through the study period	Project Team	
	Data analysis	Written summary	Primary data collected by project team	Once, updated as needed	Project Team	
How helpful is it to have someone in a resident's care network notified that their home is dangerously hot?	Survey data (% of alerts acted upon by caretaker)	Qualtrics survey	Primary data collected by project team	Three times	Project Team	
	Interview data (thematic analysis)	Phone interview	Primary data collected by project team	Once	Project Team	

What were any difficulties in implementing this intervention?	Interview data (frequency of themes related to barriers to implementation)	Phone interview	Primary data collected by project team	Once	Project Team	

Table #. Plan of action for dissemination

Audience for evaluation findings	Evaluation information of interest [what pieces of this evaluation would they by most interested in?]	Purpose of communicating to this audience [they make decisions about evaluation design/activities, they have requested to be updated, they will be presenting the finding elsewhere, etc]	Potential dissemination formats [infographics, formal presentation, conference, manuscript, etc]	Month and year of planned dissemination	Person(s) responsible for dissemination
Residents who took part in the intervention	Effectiveness of the intervention	So they know how their actions influence their risk to extreme heat	Flyer/infographic (slightly personalized)	March 2022	
Project Stakeholders	Effectiveness of the intervention, barriers to implementation	To assess if this intervention could be useful to scale up	Final report, formal presentation	March 2022	
General Public	Effectiveness of the intervention	Understand the risk associated with indoor heat	AZ Department of Health Services Heat Safety webpage	April 2022	
Professional Stakeholders (includes government, media, non-profit, etc)	Effectiveness of the intervention, barriers to implementation	To communicate an intervention that might be useful in other communities dealing with high indoor temperatures	Formal presentation	February 2022	
Academia	Effectiveness of the intervention, role of risk perception	Advancing scientific understanding of effective interventions to address indoor temperature	Peer reviewed publication	March 2022	

	plays in acting on alerts				

[Completing these sections partially satisfies Performance Measure H].