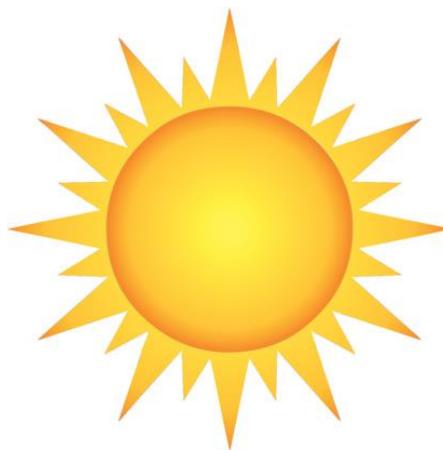


North Carolina Climate and Health Implementation and Monitoring Strategy (IMS) for Heat-Related Illness



This Implementation and Monitoring Strategy (IMS) is a living document. It outlines a plan of action for the North Carolina Division of Public Health to implement adaptations and interventions aimed at disrupting the pathway between extreme heat and its subsequent health outcomes.

The interventions and adaptations outlined in this document were designed following the BRACE framework (Steps 3 and 4), with significant input from and collaboration with local stakeholders. 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 the IMS over time will satisfy performance measure K of the CDC-RFA-EH16-1602.

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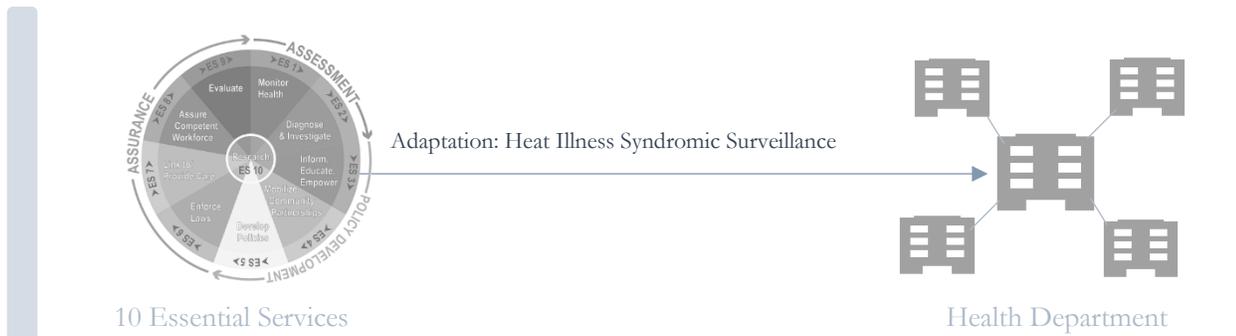
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SELECTED EXPOSURE-RESPONSE ADAPTATIONS AND INTERVENTIONS

EXPOSURE – RESPONSE PATHWAY

Public Health System-Focused



Community-Focused

Background on Climate and Heat-Related Illness

The North Carolina Climate and Health Program is housed in the North Carolina Department of Health and Human Services, Division of Public Health located in Raleigh, NC. The North Carolina Climate and Health Program was established through CDC's Climate-Ready States and Cities Initiative (CRSCI) in 2010 to address the health impacts of climate. Using the Building Resilience Against Climate Effects (BRACE) framework, North Carolina identified heat-related illness and wildfire health impacts as main priorities¹.

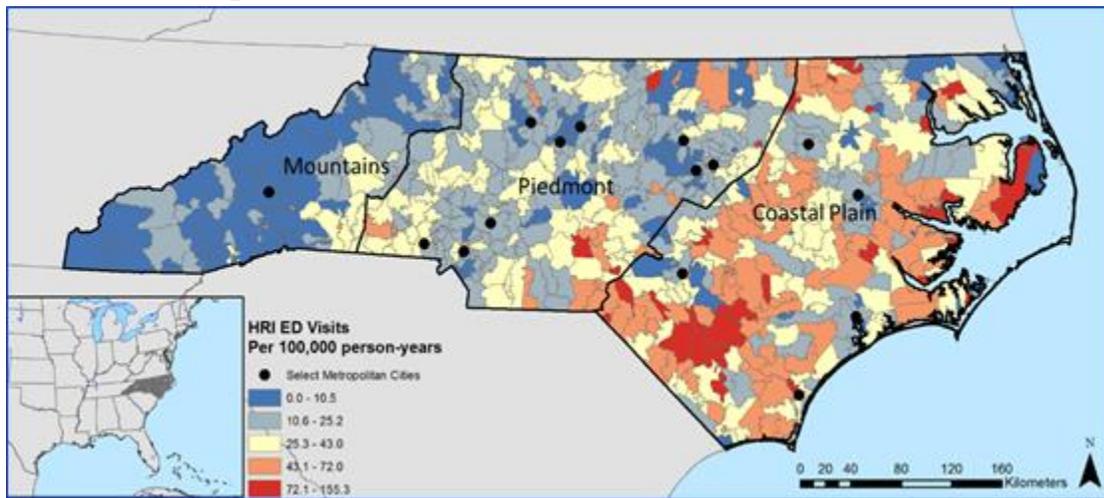
There is widespread scientific agreement that our climate is changing. Some changes will likely include an increase in the frequency and intensity of extreme heat events, heavy precipitation events, flooding, droughts, more intense storms, and air pollution. Each of these changes have potentially negative impacts on public health².

While climate's impact on health is a global issue, the effects will vary across geographic regions and populations. In North Carolina, heat-related illness (HRI) is an annual concern. Model projections have suggested an annual increase of 15-20 days with maximum temperatures exceeding 95°F between 2041 and 2070. On average, there are approximately 4,000 emergency department visits for HRI during heat season (May 1 – September 30) in North Carolina. The majority of emergency department visits for HRI are among males, particularly those between the ages of 25-34 years of age. Though anyone can be affected by complications from HRI, older North Carolinians (>65 years) are more likely to be hospitalized for HRI^{3, 4, 5}.

Additionally, the impacts of HRI are expected to be felt more in underserved communities of North Carolina where, along with a disproportionate burden of respiratory and cardiovascular disease, residents have limited capacity to adapt to warming temperatures^{6, 7}.

Previous analyses identified the Coastal Plains, an 11-county region in Southeastern North Carolina, as the geographic area with the highest rates of emergency department visits for HRI in the state.

Figure 1. HRI ED visits per 100,000 person-years during May-September 2007-2012. HRI ED visits are acquired through NC-DETECT. Map also includes regional locations and cities with metropolitan characteristics¹⁴



Within the Coastal Plains region, people over age 65, outdoor workers, youth and high school athletes, those with limited resources, and those living in mobile homes are particularly vulnerable to HRI^{5,8}. Most of the region is rural, limiting access to potential resources such as cooling centers and public transportation, further increasing vulnerability.

The HRI work is focused in Bladen, Robeson, Sampson, and Scotland counties. NC DPH focused on these counties because they had the highest emergency department visits related to HRI. NC DPH interviewed 14 stakeholders who represented vulnerable populations in these four counties, to assess current HRI efforts and community knowledge on HRI.

NC DPH used the Community Readiness Model (CRM) to survey stakeholders⁹. Under this model, community readiness is defined as the degree to which a community is willing and prepared to act on an issue, in this instance, on HRI. For this analysis, NC BRACE has adapted the following dimensions of community readiness:

- Knowledge of the issue – How much does each vulnerable population know about HRI
- Knowledge of existing efforts – How much does each population know about current programs and activities intended to address HRI?
- Community climate – What is each population’s attitude toward addressing HRI?
- Resources – What are the resources that are being used or could be used to address HRI

In addition to knowledge and perceptions of efforts, NC DPH has considered what programs or efforts are currently being implemented for various vulnerable populations in each of the four counties.

Implementation and Monitoring Strategy (IMS)

In 2010, North Carolina was one of 16 states to receive the Centers for Disease Control and Prevention (CDC) Building Resilience Against Climate Effects (BRACE) grant¹. The grant program specifies the following five-step process designed to aid health officials in developing strategies and programs to help communities prepare for the impact of climate on health.

1. Anticipate climate impacts and assess vulnerabilities
2. Project the disease burden
3. Assess public health interventions
4. Develop and implement a climate and health adaptation plan
5. Evaluate impact and improve quality of activities

Following this framework, the Occupational and Environmental Epidemiology Branch (OEEB) of the North Carolina Department of Public Health (NC DPH) conducted health assessments to determine which climate-related health impacts were most prevalent in North Carolina, and which geographic areas were most affected. Syndromic surveillance of emergency department (ED) visits for heat exhaustion, heat cramps, and heat stroke during summer months indicated that HRI is a major climate-related public health concern⁴.

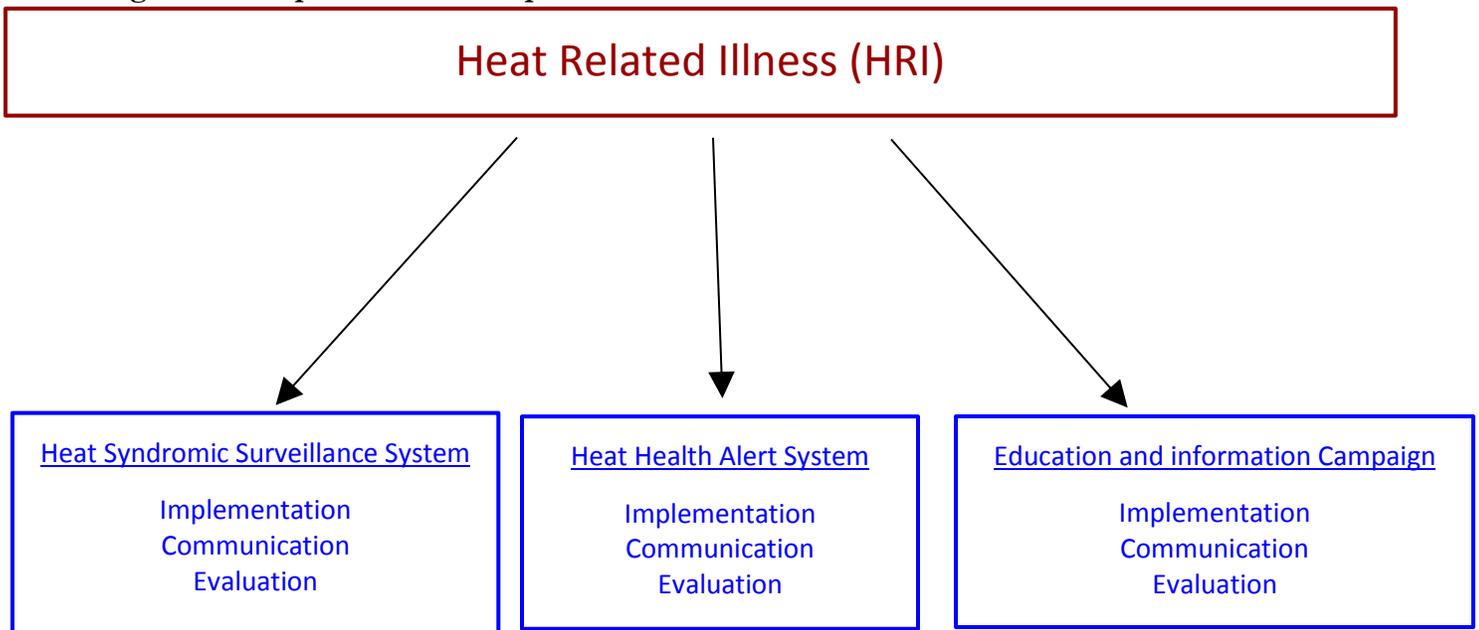
The goal of this IMS is to outline a plan of action that can help minimize the health impacts of HRI by disrupting the pathway between rising temperatures, exposure to extreme heat, and adverse health outcomes. The IMS is a framework provided by the CDC for guiding public health interventions intended to disrupt the exposure pathway of hazards, behaviors, and health outcomes, such as heat-related illness. Like other strategic planning efforts, the IMS includes internal agency leadership support and resources, as well as support from external advocates, community or stakeholder input, and additional resources that will contribute to its long-term effectiveness and sustainability.

The IMS is a strategy for change that combines internal public health adaptations and external community interventions. Adaptations are focused on public health system-level actions linked to the 10 Essential Service of Public Health. Community interventions are focused on local-level actions, which are linked to Public Health Practice. Each adaptation or intervention includes three components – implementation, communication, and evaluation – outlined below.

This IMS will focus on two interventions that have been prioritized by the North Carolina Climate and Health Program working with key stakeholders in vulnerable communities:

1. Adaptation- Heat Syndromic Surveillance System
2. Intervention 1 - Heat Health Alert System
3. Intervention 2 - Education & Information Campaign

Figure 3. Components of an Implementation Plan of Action



Adaptation: Heat Syndromic Surveillance System

Implementation

Context and Rationale

North Carolina’s syndromic surveillance system is called the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT). This system was created by NC DPH and Carolina Center for Health Informatics (CCHI).

This adaptation has more than seven years of implementation in North Carolina, with annual, regular engagement from a variety of state agencies, such as NC Emergency Management and NC Department of Labor. Effectiveness of this adaptation is influenced by epidemiological and communication capacity and access to data.

Description of Adaptation or Intervention

The heat syndromic surveillance system is used to describe HRI in North Carolina, and disseminates that information to an inter-agency HRI working group regularly.

Site locations

The Heat Syndromic Surveillance System is website based. Using the data provided by NC DETECT, NC DPH produces weekly heat syndromic surveillance data during May – October to stakeholders.

Methodology

The heat syndromic surveillance system was created in response to a heat wave in 2010. Since then, weekly heat syndromic surveillance reports are distributed to stakeholders during the summer months. This IMS offers the opportunity to evaluate the system and to demonstrate the system’s utility as an adaptation.

Local Data

NC DPH will use qualitative data from the heat syndromic surveillance through summer 2017 meeting notes and a future survey of system stakeholders. NC DPH will also use quantitative data on reports distributed through the summer. This data will be used to answer evaluation questions.

Heat Syndromic Surveillance System Stakeholder and Team Roster and Responsibilities

- NC DETECT staff
 - Maintains syndromic surveillance data system
- NC BRACE staff (Lauren Thie, Environmental Program Consultant; Lisa Garland, Climate Health Educator; Sarah Shaughnessy, Climate & Health Program Assistant; Mina Shehee, Branch Head)
 - Conduct qualitative assessment, host meetings, distribute system reports
- Interagency Heat-Related Illness Working Group
 - Host meetings, give feedback, and evaluate program and materials

Heat Syndromic Surveillance System Timeline with Milestones and Deadlines

2018	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Review past syndromic surveillance reports and heat website prior to 2018 heat season												
Create weekly heat syndromic surveillance reports												
Finalize end of season report												
Evaluate heat syndromic surveillance system												

Needed Resources

This adaptation requires continued BRACE funding, access to emergency department and meteorological data, and skilled epidemiological and communication staff.

Objective

The heat syndromic surveillance system communication strategy’s primary goal is to promote stakeholder engagement with and utilization of trends of HRI in North Carolina.

Heat Syndromic Surveillance System Activities

Promote regular stakeholder engagement with heat syndromic surveillance data			
<p><u>INPUTS→ACTIVITIES</u></p> <ul style="list-style-type: none"> Weekly descriptive epidemiology heat-related illness report 	<p><u>STAKEHOLDERS</u></p> <p>Climate and Health Educator Lisa Garland, Climate and Health Environmental Program Consultant Lauren Thie, Interagency Heat-Related Illness Working Group</p>	<p><u>TARGET AUDIENCE</u></p> <p>Interagency Heat-Related Illness Working Group and other partners (including Sustainable Sandhills)</p>	<p><u>TIMELINE</u></p> <p>Weekly May - September</p>
Facilitate utilization of heat syndromic surveillance data			
<p><u>INPUTS→ACTIVITIES</u></p> <ul style="list-style-type: none"> Responses to requests from interagency HRI working group for heat related illness epidemiological data <ul style="list-style-type: none"> 2 emails (May, July) informing Interagency stakeholders of availability of heat illness epidemiology support 	<p><u>STAKEHOLDERS</u></p> <p>Climate and Health Educator Lisa Garland, Climate and Health Environmental Program Consultant Lauren Thie, Interagency Heat-Related Illness Working Group</p>	<p><u>TARGET AUDIENCE</u></p> <p>Interagency Heat-Related Illness Working Group and other partners (including Sustainable Sandhills)</p>	<p><u>TIMELINE</u></p> <p>May-September</p>

Evaluation Purpose

The purpose of these evaluation indicators and analyses is to determine how successful the heat syndromic surveillance system is.

Heat Illness Syndromic Surveillance Stakeholder Engagement Table

Stakeholder name or group	Stakeholder category	Interest of perspective	Role in evaluation
NC DPH	Primary	All stakeholders are interested in preventing heat illness through improved understanding of heat illness trends.	NC DPH will conduct evaluation of the heat syndromic surveillance system, including distributing surveys and collecting data. CCHI will provide feedback.
CCHI	Secondary		
Interagency Heat Related Illness Working Group	Secondary		Will provide feedback.

Cultural Humility

The heat syndromic surveillance system describes heat related illness by age, gender, and geographical location within the state¹⁰.

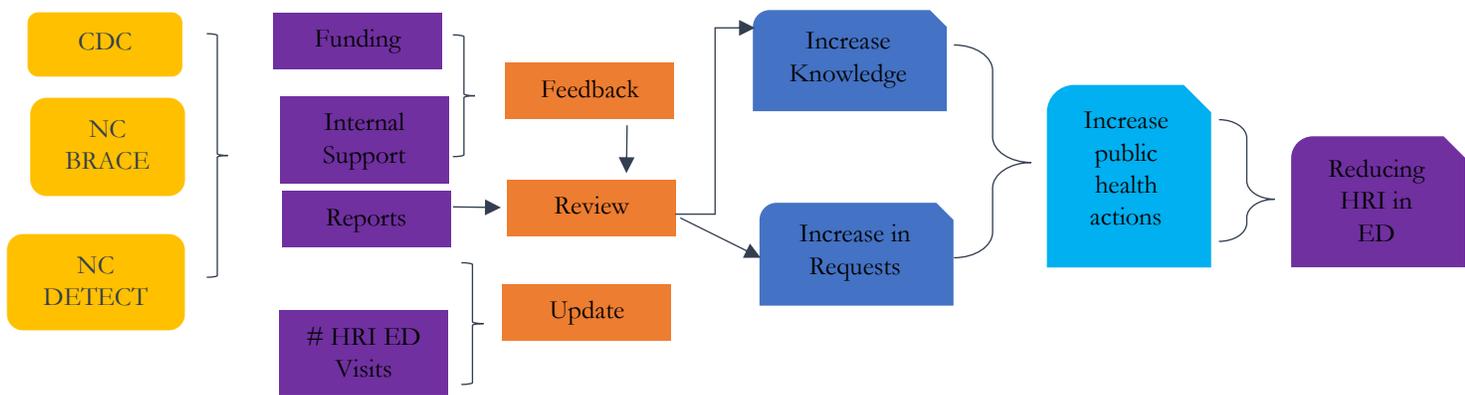
Population addressed

- The Heat Syndromic Surveillance System describes HRI occurring in North Carolina during the summer months. This illness occurs at higher rates among males ages 19-44 in the Coastal Plains region of the state. Risk factors for illness include non-citizenship, mobile homes, age over 65, labor intensive crops, and poverty⁸.

Heat Syndromic Surveillance Adaptation Description Table

Resources/Inputs	Activities		Outputs	Outcomes		
	Initial	Subsequent		Short-Term	Intermediate	Long-term
CDC BRACE Funding	Give funds and support	Support	Heat Syndromic Surveillance Reports	Increase in knowledge of heat related illness trends	Increase in public health actions taken in response to heat illness information	Reducing heat related illness emergency department visits
NC BRACE staff	Compile reports based on NC DETECT data	Review reports and update stakeholder list	Email reports summarizing heat syndromic surveillance reports			
NC DETECT system	Count number of ED visits based on HRI		Email promoting availability of epidemiological report	Increase in requests for heat epidemiological data		

Heat Syndromic Surveillance Adaptation Logic Model Flow



Syndromic Heat Surveillance System Evaluation Questions and Data Collection Methods

Intervention Component	Evaluation Component	Question	Indicator	Data Source(s)	Analysis	Use
Syndromic surveillance	Reach*	Are the heat reports reaching stakeholders?	Percentage of stakeholders who receive heat reports	Stakeholder survey	Calculate percentage	Formative
	Reach	Are the people in the stakeholder group relevant to the HRI working group?	Desired relevant types of all stakeholders	Survey	Summarize number of relevant stakeholders	Summative
	Dose received	Do the heat reports improve your knowledge on HRI?	Percentage of stakeholders who indicate that they find the heat reports useful in identifying patterns of HRI in NC	Stakeholder survey, inclusion and satisfaction items	Calculate percentages from surveys	Formative
	Outcome	What public health actions do stakeholders take using the heat reports of HRI in NC?	Type of public health actions that stakeholders take during heat season based on the information from heat reports	Stakeholder survey	Summarize the type of public health actions	Summative

***Reach** is a component of process evaluation, which refers to the proportion of intended target audience that participates in an intervention. If there are multiple interventions, then it is the proportion that participates in each intervention component. Reach is a characteristic of the target audience.

Dose Received is a component of process evaluation, which refers to the extent to which participants actively engage with, interact with, are receptive to, and/or use materials or recommended resources. Dose received is a characteristic of the target audience and it assesses the extent of engagement of participants with the intervention.

Outcome is a component of an impact evaluation, which refers to the specific outcomes associated with an intervention¹⁰.

Heat Syndromic Surveillance System Plan of Action for Dissemination Table

Audience for evaluation findings	Evaluation information of interest	Purpose of communicating to this audience	Potential dissemination formats	Month and year of planned dissemination	Person(s) responsible for dissemination
NC BRACE Staff	Success of system in promoting a reduction in illness	Evaluation designers, creators of heat syndromic surveillance system reports	Presentation, Manuscript	February 2019	Climate and Health Educator Lisa Garland
CDC Climate and Health Staff	Success of system in promoting a reduction in illness	Invested in expanding climate and health evidence base	Presentation, Manuscript	February 2019	Climate and Health Educator Lisa Garland, Climate and Health Environmental Program Consultant
NC DETECT staff	Success of system in promoting a reduction in illness	Invested in the success of the system they maintain and run	Presentation, Manuscript	February 2019	Climate and Health Educator Lisa Garland
Interagency Heat Illness Working Group	Engagement with heat related illness data and success of system in promoting a reduction in illness	Interested in engaging with heat illness data and the success of their dissemination of heat illness trends	Presentation	Summer 2019	Climate and Health Educator Lisa Garland

Intervention 1: Heat Health Alert System

Implementation

A heat alert system is a response plan prepared by a city, county, or other regional municipality which is activated when the air temperature or heat index reaches or exceeds a predetermined threshold and is deemed dangerous to human health¹².

Context and Rationale

This intervention was selected based on a systematic literature review, which compiled evidence based interventions for reducing HRI²

- Largest evidence base, demonstrated success in similar contexts
- Evidence of health impacts below National Weather Service (NWS) advisory, watch, and warning system levels⁵
- Extreme heat is one of the main causes of mortality related to weather in the United States¹³ Negative health outcomes from heat exposure include heat cramps, heat stroke, heat exhaustion, and death⁷
- Stakeholders ranked this intervention highly using a prioritization strategy
 - Participatory process was essential in the development of this IMS
 - NC BRACE can be most effective by building on current local efforts, utilizing local expertise, and working through existing channels of health and social service provision.
 - Greater understanding of local need, barriers, and resources
 - Greater potential for sustainability

Description

- Successful examples include New York City's heat alert system and Arizona's Climate and Health Adaptation Plan².
- This system will include the 4 components from the CDC intervention assessment²
 - Community Education and Engagement
 - Preparing the communities for upcoming heat season
 - Alert Protocol
 - Identifying trigger alerts for communities to use
 - Community Outreach Plan
 - Create procedure to reach populations in each community
 - Communication Plan
 - Delivers information about HRI impacts and trigger alerts through different communication methods
- Each heat health alert system will be context-specific; details will be determined in collaboration with local stakeholders and key intervention specialists in each of the four target counties: Bladen, Robeson, Sampson, and Scotland counties.

Populations Addressed

Heat illness is an increasing concern in North Carolina and across the Coastal Plains. Local communities vary in their awareness of heat health issues, the type of heat illness prevention programs already in place, and the priority given to those programs. Using a framework adapted from the (CRM, NC DPH interviewed key stakeholders in assessing current heat-illness prevention efforts, identify needed resources for future efforts, and select a target population for piloting a heat alert system.

Based on qualitative analysis of this information, NC DPH will tailor the heat health alert system to the following respective populations in each of four counties:

- Bladen County - Agricultural workers
- Robeson County - Low-income people, those living in mobile homes
- Sampson County - Low income and older adults
- Scotland County – Youth

Site Locations

This intervention will consist of physical and digital components in Bladen, Robeson, Scotland, and Sampson counties in Southeastern North Carolina. More specific locations will be determined via partnerships with location-specific prevention specialists.

Implementation Methodology

- Meet with contractors and local stakeholders to cultivate a list of prevention specialists who can speak to the needs and priorities of members of each target population in each county, as listed above.
- Work with county prevention specialists to develop specific messages and communication channels for heat alerts
- Tailor Heat Health Alert System major components: community education and engagement, alert protocol, community outreach plan, and communication plan.
 - Community Education and Engagement
 - Identify community needs by conducting a needs assessment, recruit stakeholders in each county, educate the public by training prevention specialists in each county using a health education curriculum, and develop a heat health alert system. Prevention specialists will be able to add their input regarding the health education curriculum.
 - Alert Protocol
 - Develop a trigger alert that will make people aware of high heat days and the precautions they should take on those days. Prevention specialists will use information about epidemiological studies identifying potential, morbidity-centric trigger alert levels. NC DPH will work with prevention specialists to pick a trigger alert level that will work best for the target population in their county, including considering potential message fatigue for the population.

-Prevention specialists likely understand population capacity for messaging and alerts, and therefore are best prepared to determine trigger alert levels and the resulting number of messages/alerts/communications during the heat season. Trigger alert levels for each county will be decided by March 2018, in time for development of appropriate materials and communications.

- Community Outreach Plan
 - Create a framework to reach out to vulnerable populations in each county. Prevention specialists will use a curriculum designed by NC DPH and Sustainable Sandhills staff to implement the alert protocol. Prevention specialists will reach the targeted population in their county using different communication methods such as email, meetings, etc. A community outreach plan will be decided by April 2018.
- Communication Plan
 - Develop ways to deliver the heat health alert system in each county through different communication methods and a health education curriculum. Prevention specialists will work with NC DPH to identify ways to effectively communicate the heat health alert system with the targeted population(s).

Local Data

NC DPH will use qualitative data about community readiness from Bladen, Robeson, Sampson, and Scotland counties in Southeastern North Carolina to evaluate the implementation of the heat health alert system. This data was collected in Summer 2017 from in-depth interviews with relevant stakeholders. NC DPH staff also conducted a literature review² and developed a Community Readiness Model report that will be used for this intervention.

Heat Health Alert System Stakeholder and Team Roster and Responsibilities

- NC BRACE staff (Lauren Thie, Environmental Program Consultant; Lisa Garland, Climate Health Educator; Sarah Shaughnessy, Climate & Health Program Assistant; Mac Ledgerton, Climate and Health Program Consultant; Mina Shehee, Branch Head)
 - Conduct qualitative assessment, host meetings, identify communication channels, update stakeholders, develop training curriculum, and evaluate program
- Sustainable Sandhills staff (Gabrielle Marshall, Climate and Health Program Contractor; contractor works with NC BRACE staff on curriculum development and other logistics)
 - Identify communication channels, update stakeholders, develop training curriculum, and evaluate program
- Coastal Plains Stakeholder Group (see appendix A for list of stakeholders; the list includes stakeholder across four counties representing various members of communities such as local government, medicals, and academic)
 - Host meetings, give feedback, and evaluate program and materials
- Prevention Specialists from Bladen, Robeson, Sampson, and Scotland counties
 - Educate community members, host meetings, give feedback, and evaluate program

and materials

Heat Health Alert System Timeline with Milestones and Deadlines

2017	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Conduct qualitative assessment in each county												
Intervention stakeholder meeting												
Meet and recruit stakeholders												
Draft IMS and CRM												
2018	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Communicating CRM and IMS												
Identify Prevention Specialists												
Heat Health Alert Development												
Develop trigger alert levels with prevention specialists												
Heat Health Alert Dissemination												
Heat Health Alert Curriculum Development												
Heat Health Alert Evaluation												

Funding

- CDC grant supporting NC BRACE staff
- Stakeholders funding that allows continued involvement, such as local health department or

agriculture extension funding

Personnel

- NC BRACE staff (Lauren Thie, Environmental Program Consultant; Lisa Garland, Climate Health Educator; Sarah Shaughnessy, Climate & Health Program Assistant; Mac Ledgerton, Climate and Health Program Consultant; Mina Shehee, Branch Head)
- Sustainable Sandhills staff (Gabrielle Marshall, Climate and Health Program Contractor; contractor works with NC BRACE staff on curriculum development, trigger protocols, and other logistics)
- Community stakeholders (local health departments, Agriculture Extension, local planners, local health directors, local Parks and Recreation staff, EMS, Emergency Management, Farmworker Health Programs, etc.)

Equipment and Materials

- Technology capacity to conduct webinars and in-person trainings as needed for county-specific prevention specialists on heat health alert system
- Monitoring and evaluation expertise
- Access to NC DETECT data and peer reviewed literature on interventions and climate effects
- Time and space to plan meetings
- Education materials developed by Sustainable Sandhills and NC DPH

Communication

Objective

The primary objective of this communication strategy is to communicate how the Heat Health Alert System will be implemented through:

- Community meetings
- Stakeholder meetings
- Group trainings
- Train the trainer/educator trainings with prevention specialists

Heat Health Alert System Activities

Communicate IMS and CRM plan to stakeholders for their review and input			
<u>INPUTS → ACTIVITIES</u>	<u>STAKEHOLDERS</u>	<u>TARGET AUDIENCE</u>	<u>TIMELINE</u>
IMS for HRI CRM Report Meeting space	Local stakeholders including agriculture workers, health department staff, hospital administrators, and others	Agricultural workers in Bladen county, low income people and those living in mobile homes in Robeson county, older adults and low-income people in Sampson county, and youth in Scotland county	January 2018
Communicate alert protocol			
<u>INPUTS → ACTIVITIES</u>	<u>STAKEHOLDERS</u>	<u>TARGET AUDIENCE</u>	<u>TIMELINE</u>
Health education curriculum that explains how heat health alert system works	Local stakeholders including agriculture workers, health department staff, hospital administrators, and others	Agricultural workers in Bladen county, low income people and those living in mobile homes in Robeson county, older adults and low-income people in Sampson county, and youth in Scotland county	April-May 2018
Develop outreach plan with specialists			
<u>INPUTS → ACTIVITIES</u>	<u>STAKEHOLDERS</u>	<u>TARGET AUDIENCE</u>	<u>TIMELINE</u>
Health education curriculum that explains how heat health alert system works Webinars, phone calls, and emails as needed.	Local stakeholders including agriculture workers, health department staff, hospital administrators, and others	Agricultural workers in Bladen county, low income people and those living in mobile homes in Robeson county, older adults and low-income people in Sampson county, and youth in Scotland county	May 2018

Evaluation

The purpose of this evaluation plan is to improve the heat alert system, as well as to document successes and identify barriers in the implementation of a heat alert system. In addition, evaluation

will provide data on the efficacy of the heat alert system.

Heat Health Alert System Stakeholder Engagement

Stakeholder name or group	Stakeholder category	Interest of perspective	Role in evaluation
NC DPH	Primary	Effectiveness of Program	Serving on planning team
Sustainable Sandhills	Primary	Effectiveness of Program	Serving on planning team
HRI Stakeholders	Primary	Effectiveness of Program	Serving on planning team and external reviewer
Prevention Specialists	Secondary	Cost Angle and Effectiveness of Program	Serving on planning team and external reviewer

Cultural Humility

NC DPH staff are aware of the limitations they face regarding the different cultures of the four counties in North Carolina. NC DPH uses cultural humility to not master the culture but to learn more about the culture they are working with to better serve them¹⁰.

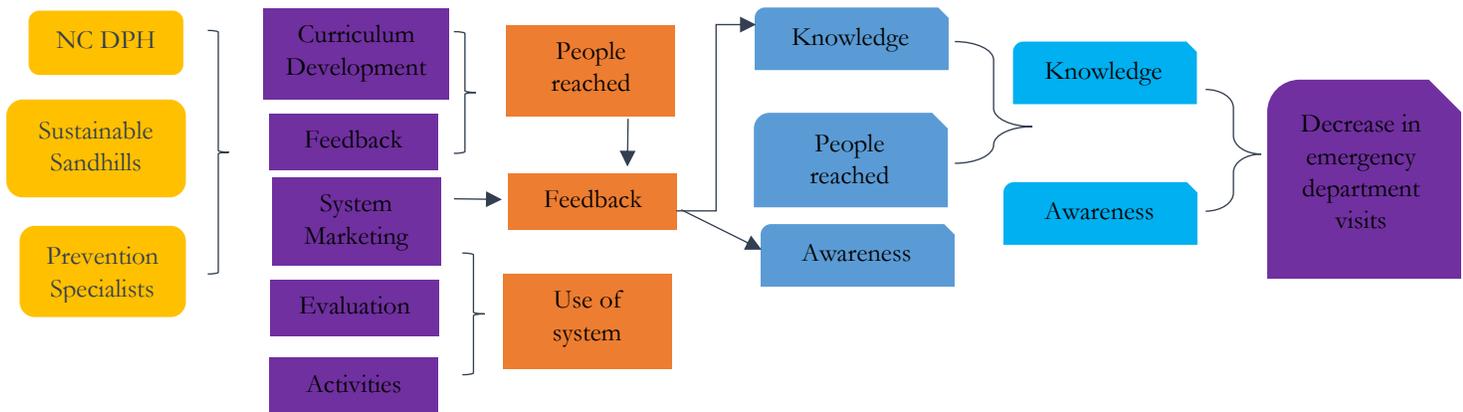
NC DPH will work to understand the community that they are working with and make sure that the community’s needs are being met in an effective manner. NC DPH and Sustainable Sandhills will work together to build sustainable relationships with various partners in all four counties. These partners will provide valuable feedback to improve the program.

NC DPH and Sustainable Sandhills will consider language and educational level when developing materials. Materials will be easy to understand and be effective in getting out the information to vulnerable populations.

Heat Health Alert System Description Table

Resources/ Inputs	Activities		Outputs	Outcomes		
	Initial	Subsequent		Short-Term	Intermediate	Long-term
NC DPH including: -office space -support -technical assistance	Heat Health Alert System development, marketing, and training	Updates from stakeholders Review material for accuracy	Number of people reached	Increase in knowledge on weather patterns, climate, etc. Increase in climate and health communication materials available to community Increased capacity to communicate public health messaging	Increase in number of people aware of how to increase their resiliency to climate related events Increase in number of community members' actions to increase climate resiliency	Increase in community resilience to climate related hazards Reduction in heat-related emergency department visits.
	Conduct qualitative assessment	Give results to stakeholders of qualitative assessment	Number of materials reviewed			
Sustainable Sandhills	Heat Health Alert System development, marketing, and training					
Coastal Plains Prevention Specialists	Implement communication plan	Help create Heat Health Alert System				
Coastal Plains Stakeholders	Surveys	Give feedback	Feedback			
CDC Funding	Give feedback					

Heat Health Alert System Logic Model Flow



Heat Health Alert System Evaluation Questions and Data Collection

Intervention Component	Evaluation Component	Question	Indicator	Data Source(s)	Analysis	Use
Heat health alert system: Community Engagement	Reach*	Did development of a heat health alert system include the target population?	Percentage of total participants that represent members of target population(s) (defined by county)	Process evaluation survey demographic items	Internal tabulation	Formative
	Dose delivered	Did engagement sessions include all components?	Percentage of total engagement sessions that included all components (i.e. educational materials)	Checklists or notes completed by BRACE staff or prevention specialists	Calculate percentage of engagement sessions that included sufficient threshold of components	Formative
	Dose received	Did local stakeholders find the information useful in helping them prepare for heat season?	Percentage of participants who found the engagement activities useful	Process evaluation survey, satisfaction items	Calculate percentage of participants who found sessions useful	Formative and summative

	Context	What were external barriers and facilitators to community engagement sessions?	Qualitative descriptions of external barriers and facilitators	Checklists or notes completed by BRACE staff or prevention specialists; Participant survey	Review notes for major external barriers and facilitators to outreach events	Formative and summative
Heat health alert system: Alert Protocol	Reach	Are alerts reaching the target population?	Percentage of people that receive alerts	Participant survey, demographic items	Calculate the percentage of participants in each subpopulation for which the alerts are intended, based on age, income, occupation, and other relevant demographic characteristics	Formative and summative
	Dose delivered	Were alerts distributed on all days that met trigger alert criteria?	Number of alerts disseminated on days meeting trigger alert criteria	Alert dissemination records; weather report data	Calculate percentage of alerts disseminated on days meeting trigger alert criteria	Formative and summative
	Outcome	Are the alerts effective in getting people to change their behavior?	Percentage of alert recipients who self-reported at least one behavior modification.	Participant survey items	Calculate percentage of alert recipients who self-reported a change in behavior	Summative
	Context	What external factors prevented residents from receiving alerts?	Description of external barriers	Participant survey	Aggregate external barriers	Formative and summative
		What external factors prevented residents from changing their behavior after receiving alerts?	Description of external barriers	Participant survey, open-ended item	Aggregate external barriers	Formative and summative

	Recruitment	How were prevention specialists recruited?	Qualitative description of recruitment methods	Checklists or notes completed by BRACE staff or prevention specialists	Qualitative analysis of staff notes	Formative and summative
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***Reach** is a component of a process evaluation, which refers to the proportion of intended target audience that participates in an intervention. If there are multiple interventions, then it is the proportion that participates in each intervention component. Reach is a characteristic of the target audience.

Does delivered is a component of a process evaluation, which refers to the number or number of intended units of each intervention or each component delivered or provided. Dose delivered is a function of efforts of the intervention providers.

Dose received is a component of a process evaluation, which refers to the extent to which participants actively engage with, interact with, are receptive to, and/or use materials or recommended resources. Does received is a characteristic of the target audience and it assesses the extent of engagement of participants with the intervention.

Context is a component of a process evaluation, which refers to aspects of the larger social, political, and economic environment that may influence intervention implementation.

Recruitment is a component of a process evaluation, which refers to procedures used to approach and attract participants.

Outcome is a component of an impact evaluation, which refers to the specific outcomes associated with an intervention¹¹.

Heat Health Alert System Plan of Action for Dissemination

Audience for evaluation findings	Evaluation information of interest	Purpose of communicating to this audience	Potential dissemination formats	Month and year of planned dissemination	Person(s) responsible for dissemination
NC DPH	Success of program	Will make decisions about program	Report	December 2018	NC DPH Staff
Sustainable Sandhills	Success of program	Will make decisions about program	Report	December 2018	NC DPH Staff

Prevention Specialists	Success of program	Will make decisions about program	Report	December 2018	Prevention Specialists
Stakeholders	Success of program	Will make decisions about program	Email	December 2018	Stakeholders

Intervention 2: Education and Information Campaign

Implementation

Context and Rationale

NC BRACE staff and the stakeholder team will develop informational and educational materials on how to use the heat alert system as well as on how to identify, treat, and prevent HRI. Messaging and the modes of communication for this information will be tailored to the priority populations identified through the CRM survey and analysis.

The education and information campaign is a set of curricula designed to teach community members about the heat health alert system. A health education curriculum will be developed and utilized for implementation of the heat health alert system in each county. These curricula will be the baseline for all education work. Each county's curriculum will be slightly different, depending on the heat health alert system that best fits each county.

Site locations

This intervention will consist of physical and digital components in Bladen, Scotland, Sampson, and Robeson counties in Southeastern North Carolina. More specific locations will be determined via partnerships with location-specific prevention specialists. Interventions will be physical and digital.

Populations Addressed

Heat illness is an increasing concern in North Carolina and across the Coastal Plains. Local communities vary in their awareness of heat health issues, the type of heat illness prevention programs already in place, and the priority given to those programs. Using a framework adapted from the CRM, NC DPH interviewed key stakeholders in assessing current heat-illness prevention efforts, identify needed resources for future efforts, and select a target population for piloting a heat alert system.

Based on qualitative analysis of this information, NC DPH will tailor the heat health education and information campaign to the following respective populations in each of four counties:

- Bladen County - Agricultural workers
- Robeson County - Low-income people and those living in mobile homes
- Sampson County - Low income and older adults
- Scotland County - Youth

Curriculum Design and Implementation Methodology

DPH staff conducted a literature review on HRI in North Carolina. DPH staff also interviewed 14 stakeholders in the four counties regarding HRI, programming, and need for their county. Using this data, DPH staff and Sustainable Sandhills will create an education and information campaign/curricula for the above populations to utilize when learning how to use the Heat Alert System. These curricula will be used by community champions/prevention specialists who will be

trained under a “train the trainer” program implemented by DPH staff.

Local Data

NC DPH will use a literature review on HRI in North Carolina along with stakeholder meeting notes and qualitative data about community readiness from Bladen, Robeson, Sampson, and Scotland counties in Southeastern North Carolina.

Education and Information Campaign Stakeholder and Team Roster and Responsibilities

- NC DPH - NC BRACE
 - Primary lead who will oversee program components and aid campaign implementation. NC DPH will also evaluate the program
 - Curriculum development
 - Translation of materials into Spanish
- Coastal Plains Stakeholder Group (see appendix B for list of stakeholders; the list includes stakeholder across four counties representing various members of communities such as local government, medicals, and academic)
 - Secondary lead who will provide data to be used to choose groups (within their county) to introduce information. This lead will also choose the appropriate communication channels to reach the groups. This group will also read the community readiness report, offer feedback, and help disseminate information about programs.
- Prevention Specialists from Bladen, Sampson, Robeson, and Scotland counties
 - Primary/secondary leads from each county who will choose trigger alert threshold and disseminate information and education to community members.
- Sustainable Sandhills
 - Primary lead who will oversee program components and aid campaign implementation. Assist in program evaluation.

Education and Information Campaign Timeline with Milestones and Deadlines

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<u>2017</u>												
Assessment of qualitative data												
Development of Heat Health Alert System curriculum/lesson plans												

Identify and contact Coastal Plains prevention specialist(s) for each county												
2018	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat Health Alert System Curriculum Development												
Heat Health Alert System Curriculum Training												
Heat Health Alert System Curriculum Marketing												
Draft pre-and post-evaluation survey to measure awareness of heat-health risks and applicable resources												
Heat Health Alert System Curriculum Monitoring and Evaluation												
Process Evaluation												
Revision and Communication												

Funding

CDC grant supporting NC BRACE staff

Personnel

- NC BRACE staff (Lauren Thie, Environmental Program Consultant; Lisa Garland, Climate Health Educator; Sarah Shaughnessy, Climate & Health Program Assistant; Mac Ledgerton, Climate and Health Program Consultant; Mina Shehee, Branch Head)
- Sustainable Sandhills staff (Gabrielle Marshall, Climate and Health Program Contractor; contractor works with NC BRACE staff on curriculum development, trigger protocols, and other logistics)
- Community stakeholders (local health departments, Agriculture Extension, local planners, local health directors, local Parks and Recreation staff, EMS, Emergency Management, Farmworker Health Programs, etc.)

Equipment and Materials

- Office and PC programs to develop educational content
- Technology capacity to conduct webinars and trainings (if needed)

Communication

Objective

The primary objective of this communication strategy is to describe to local stakeholders and health officials how the Heat Health Alert System is designed and how it should be implemented.

By using the curricula designated for each county, NC DPH will be able to better educate leaders in the community. NC DPH will implement a “train the trainer” program where the prevention specialists will take initiative and be able to lead their county to healthier results.

Education and Information Campaign Activities

Identify and contact Coastal Plains prevention specialists to assist with health education and information material development and dissemination			
<u>INPUTS→ ACTIVITIES</u>	<u>STAKEHOLDERS</u>	<u>TARGET AUDIENCE</u>	<u>TIMELINE</u>
<ul style="list-style-type: none"> • Stakeholder roster 	Local stakeholders including agriculture workers, health department staff, hospital administrators, and other stakeholders	Agricultural workers in Bladen County, low-income earners and those living in mobile homes in Robeson County, older and low-income adults in Sampson County, and youth in Scotland County	December 2017 – January 2018
Develop heat health curriculum			

<u>INPUTS→ ACTIVITIES</u>	<u>STAKEHOLDERS</u>	<u>TARGET AUDIENCE</u>	<u>TIMELINE</u>
<ul style="list-style-type: none"> Feedback from stakeholders and prevention specialists Existing evidence-based heat health and safety intervention materials 	Local stakeholders including agriculture workers, health department staff, hospital administrators, and other stakeholders	Agricultural workers in Bladen County, low-income earners and those living in mobile homes in Robeson County, older and low-income adults in Sampson County, and youth in Scotland County	February - March 2018

Communicate curriculum goals to prevention specialists

<u>INPUTS→ ACTIVITIES</u>	<u>STAKEHOLDERS</u>	<u>TARGET AUDIENCE</u>	<u>TIMELINE</u>
<ul style="list-style-type: none"> Heat health informational materials 	Local stakeholders including agriculture workers, health department staff, hospital administrators, and other stakeholders	Agricultural workers in Bladen County, low-income earners and those living in mobile homes in Robeson County, older and low-income adults in Sampson County, and youth in Scotland County	March - May 2018

Develop and administer pre- and post- surveys to assess awareness

<u>INPUTS→ ACTIVITIES</u>	<u>STAKEHOLDERS</u>	<u>TARGET AUDIENCE</u>	<u>TIMELINE</u>
<ul style="list-style-type: none"> Heat health informational materials Survey technology 	Local stakeholders including agriculture workers, health department staff, hospital administrators, and other stakeholders	Agricultural workers in Bladen County, low-income earners and those living in mobile homes in Robeson County, older and low-income adults in Sampson County, and youth in Scotland County	March - September 2018

Evaluate and disseminate the results of information campaign

<u>INPUTS → ACTIVITIES</u>	<u>STAKEHOLDERS</u>	<u>TARGET AUDIENCE</u>	<u>TIMELINE</u>
<ul style="list-style-type: none"> • Participant surveys • Staff notes and checklists • Evaluation analysis and report 	<p>Local stakeholders including agriculture workers, health department staff, hospital administrators, and other stakeholders</p>	<p>Agricultural workers in Bladen County, low-income earners and those living in mobile homes in Robeson County, older and low-income adults in Sampson County, and youth in Scotland County</p>	<p>September 2018</p>

Evaluation

The purpose of this intervention is to effectively communicate the heat alert system and its trigger alert levels to the populations addressed in the four-county region. In addition, this intervention will be used by stakeholders and prevention specialists to educate the populations addressed about heat related illness and protection actions.

Education and Information Campaign Stakeholder Engagement

Stakeholder name or group	Stakeholder category	Interest of perspective	Role in evaluation
NC DPH	Primary	Effectiveness of program	Collecting data and interpreting findings
Sustainable Sandhills	Primary	Effectiveness of program	Collecting data and interpreting findings
Prevention Specialists	Secondary	Effectiveness of program	Receiving results and serving on planning committee
Stakeholders	Secondary	Effectiveness of program	Receiving results and serving on planning committee

Cultural Humility

NC DPH staff are aware of the limitations they face regarding the different cultures of the four counties in North Carolina. NC DPH uses cultural humility to not master the culture but to learn more about the culture they are working with in order to better serve them¹⁰.

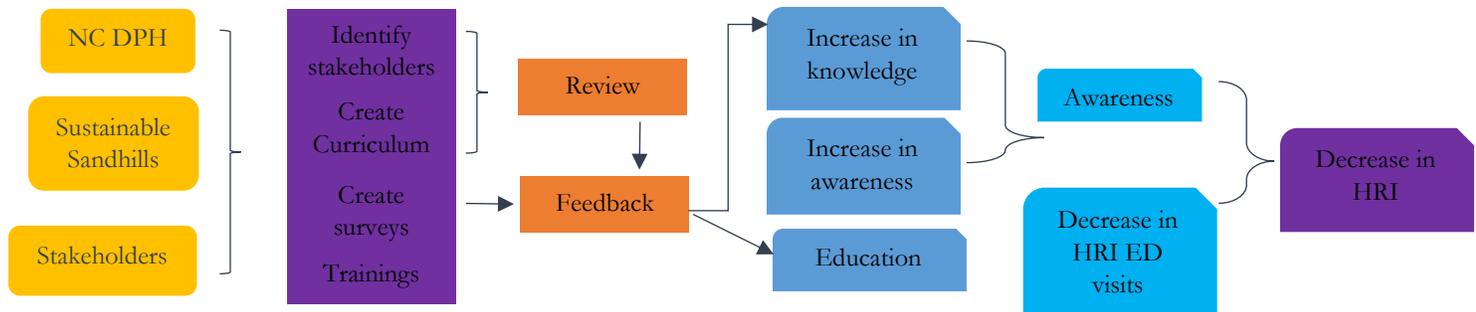
NC DPH will work to understand the community that they are working with and make sure that the community's needs are being met in an effective manner. NC DPH and Sustainable Sandhills will work together to build sustainable relationships with various partners in all four counties. These partners will provide valuable feedback in order to improve the program.

NC DPH and Sustainable Sandhills will consider language and educational level when developing materials. Materials will be easy to understand and be effective in getting out the information to vulnerable populations.

Education and Information Campaign Description Table

Resources/Inputs	Activities		Outputs	Outcomes		
	Initial	Subsequent		Short-Term	Intermediate	Long-term
NC DPH staff Sustainable Sandhills Prevention Specialists	Identify stakeholders and prevention specialists Creation, development, and evaluation of curriculum Create pre- and post- surveys Revision and communication of Heat Health Alert System curricula	Review curriculum for accuracy	Curriculum including webinars and training materials Pre-and post-surveys	Increase in knowledge of Heat Health Alert System	Increase in number of people who are aware of Heat Health Alert System	Increase in community resilience to climate related hazards Reduction in heat related emergency room visits
Local stakeholders People receiving curriculum	Get trained and take surveys on development of program	Give feedback	Number of surveys and feedback	Increase in knowledge of Heat Health Alert System		

Education and Information Campaign Logic Model Flow



Education and Information Campaign Evaluation Questions and Data Collection

Intervention Component	Evaluation Component	Question	Indicator	Data Source(s)	Analysis	Use
Education & Info: Prevention Specialist Identification and Training	Dose delivered*	Did you feel supported during the development of the training sessions?	Percentage of prevention specialists who responded yes to specific satisfaction survey items	Checklists or notes completed by BRACE staff or prevention specialists	Internal tabulation	Formative and summative
		Did the materials include all the components?	Percentage of total engagement sessions that included all components	Checklists or notes completed by BRACE staff or prevention specialists	Calculate percentage	Formative and summative
	Dose received	Did prevention specialists find the trainings useful in helping them inform the community about HRI?	Percentage of prevention specialists who responded yes to specific satisfaction survey items	Prevention specialist survey, satisfaction items	Calculate percentage of participants who found sessions useful; potentially calculate a composite satisfaction score if using multiple survey items	Formative and summative
Education & Info: Delivery of Information	Reach	How many respondents received HRI information?	Number of people who received HRI information	Participant survey, demographic items	Calculate the percentage of participants in each subpopulation for which the engagement and outreach sessions are intended, based on age, income, occupation, and other relevant demographic characteristics	Formative and summative

	Dose received	What was the attendance at outreach events?	Number of attendees at outreach events	Checklists or notes completed by BRACE staff or prevention specialists	Calculate number of attendees that attended outreach events	Formative and summative
	Dose received	Were participants satisfied with the content of the sessions?	Percentage of participants who responded in a positive way to content	Participant survey, satisfaction items	Calculate percentage of participants who found information useful	Formative and summative
	Context	What external factors were barriers or facilitators to the delivery of information?	Qualitative descriptions of external barriers and facilitators	Checklists or notes completed by BRACE staff or prevention specialists; Participant survey, open-ended item	Qualitative analysis of staff notes and survey responses	Formative and summative
	Intermediate outcome	Are the education sessions effective in getting people to change their behavior?	Number of recipients who self-reported at least one behavior modification	Participant survey item	Calculate percentage of alert recipients who self-reported a change in behavior	Summative

***Reach** is a component of a process evaluation, which refers to the proportion of intended target audience that participates in an intervention. If there are multiple interventions, then it is the proportion that participates in each intervention component. Reach is a characteristic of the target audience.

Dose delivered is a component of a process evaluation, which refers to the number or number of intended units of each intervention or each component delivered or provided. Dose delivered is a function of efforts of the intervention providers.

Dose received is a component of a process evaluation, which refers to the extent to which participants actively engage with, interact with, are receptive to, and/or use materials or recommended resources. Dose received is a characteristic of the target audience and it assesses the

extent of engagement of participants with the intervention.

Context is a component of a process evaluation, which refers to aspects of the larger social, political, and economic environment that may influence intervention implementation.

Recruitment is a component of a process evaluation, which refers to procedures used to approach and attract participants.

Outcome is a component of an impact evaluation, which refers to the specific outcomes associated with an intervention.¹¹

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Stakeholders	Success of program	Will make decisions about program	Email	December 2018	Stakeholders

Appendix A: Team and Stakeholder Roster

Heat Vulnerability in the Coastal Plains

Region Definition: Bladen, Cumberland, Harnett, Hoke, Lee, Montgomery, Moore, Richmond, Robeson, & Scotland

County or Affiliation	Name	Role
Bladen County	Debra Conner	Preparedness Coordinator
	David Hesselmeier	Preparedness Coordinator
	Sandra Cain	Extension Director
	Bruce Mclean	Extension Agent - Field Crops
	Bradley Kinlaw	EMS Director
	Alisha Evans	GIS/E911 Coordinator
City of Fayetteville	Jerry Dietzen	Director of Environmental Health Services
	Greg Schaefer	Safety Officer
	Scott Shuford	Planner
Cumberland County	Buck Wilson	Health Director
	Greg Phillips	Preparedness Coordinator
	Melvin Lewis	Emergency Management
	Gene Booth	Emergency Management
	James Bullard, Jr.	Emergency Management Coordinator
Harnett County	Tina Blackmon	Preparedness Coordinator
Hoke County	Roland Little	Preparedness Coordinator
	Freddy Johnson Sr.	Emergency Management
	Robin Lorenzen	Emergency Management
	John White	Ft. Bragg meteorologist
Lee County	Shannon Cagle	Preparedness Coordinator

	William Heath Cain (back-up)	Preparedness Coordinator
Military (Ft. Bragg)	Julia Love	Sustainable Land Use Planner, Ft Bragg
	Hannah Smith	RN, Epidemiological Disease Control (EPC) Clinic
	Howard Franklin	Chief, EPC Clinic - Ft. Bragg
	John White	Ft. Bragg meteorologist
Montgomery County	Mary Perez (supervisor)	Preparedness Coordinator
	Andrew Currin (contract)	Preparedness Coordinator
	Ashley Alfonse (contract)	Preparedness Coordinator
	Rhonda Peters	Secondary PIO
	Jamie Warner	NCSU Extension Office
Moore County	Teresa Forrest	Preparedness Coordinator
Richmond County	Holly Haire	Preparedness Coordinator
	Taylor Smith	Co-Preparedness Coordinator
	Susan Kelly	NCSU Ag Extension Agent
Robeson County	William Smith	Health Director
	Karen Woodell	Preparedness Coordinator
	Beth Rowell	Registered Nurse - Health Department
	Melissa Packer	Assistant Health Director
	Frank "Greg" Bounds	EMS Director
	Patrick Cummings	EMS Assistant Director / Training Officer
	Stephanie Chavis	Emergency Management
	Mattie Caulder	Emergency Management
	Jay Blausen	Sustainability Office UNC - Pembroke

	Cora Bullard	Director of Student Health Services - UNC Pembroke
	Michael Bullard	Environmental Health and Safety - UNC Pembroke
	Robert Strickland	
	Christy Strickland	NCSU Extension Office- Family & Consumer Sciences
	Mac Legerton	Community Action Program
	David Richardson	Lumbee River Council of Governments
Sampson County	Kelly Parrish	Co-Preparedness Coordinator
	Peggy Pollock	Co-Preparedness Coordinator
	Max Knowles	NCSU Extension Office - Livestock
	Brad Hardison	NCSU Extension Office - Horticulture
	Della King	NCSU Extension Office - Field Crops
	Guillermo Fernandez	Sampson County Extension
	Erick Herring	EMS Chief
Scotland County	Tina Clark (supervisor)	Preparedness Coordinator
	Kathie Cox	Health Educator - Health Dept.
	Shannon Newton	Extension Agent - Horticulture
	Robert Sampson	Operations Officer - Scotland County EMS
	Andy Kurtzman	Scotland Community Health Clinic
	Roylin Hammond	Emergency Management
Regional Contacts		
Cape Fear River Assembly	Tom Hoban	Executive Director
East Coast Migrant Head Start	Mercedes Hernandez	Child and Family Health Manager
FirstHealth of the Carolinas	John Ganley	Safety Director/Emergency Manager
Hawkeye Indian Cultural Center	Gwen Locklear	Founder/Vice-Chairman

Lumbee Tribe Home Energy Assistance Program	Patrick Strickland	Manager
Safe Kids	Amy Forester	Representative
Southern Regional AHEC	Andrea Novak	Administrator of Nursing, Allied and Public Health Continuing Education
Southeastern Regional Medical Center	Craig Kuhl	Safety Officer / Security Manager
	Jerry Ratajczak	
	Selina Tino	Assistant Safety Manager
Sustainable Sandhills	Alba Polonkey	Sustainability Manager
	Hanah Ehrenreich	Executive Director
UNC Healthcare	Kathryn Egan	Injury Prevention Coordinator
NC Department of Insurance	Shannon Bullock	Deputy Director

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