Building Resilience Against Climate Effects (BRACE) Project

Plan of Action: An Intervention to Increase Emergency Preparedness, Skills and Abilities

Greater Monadnock Public Health Network

February 5, 2019

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1 INTRODUCTION

1.1 OVERVIEW OF ACTIVITIES

This Plan of Action summarizes the proposed activities of a training and outreach project to Build Resilience Against Climate Effects (BRACE) project in the Southwest New Hampshire for the period beginning in January of 2019 through June of 2020. In the first half of 2019, project partners will conduct a pilot study with participants affiliated with older adult service agencies to increase awareness to the health risks of extreme precipitation events and severe weather. The project will also increase the emergency preparedness capabilities and skills of individuals and organizations participating in the intervention. Evaluation activities will include a pre and post survey of flood risk awareness and adoption of health-focused behaviors; emergency preparedness training and health risk mitigation; the use of emergency tool kits and early warning systems; and the dissemination of emergency preparedness messages through mass media to aid with long-term sustainability of the intervention. The project described in the following sections received support from regional and State partners, as well as the series of Southwest New Hampshire stakeholder groups convened in the fall of 2018 (including first responders, service agencies, and individuals that may be more vulnerable to such weather events).

1.2 PROBLEM STATEMENT

Since 1970, Southern New Hampshire has become both warmer and wetter. Over the past four decades, Average annual maximum temperatures have warmed 1.1 to 2.6 degrees Fahrenheit, the numbers of days below freezing have decreased, and the coldest nights are not as cold as they once were. Further, the number of snow-covered days has decreased and the length of the growing season is 2 to 4 weeks longer. Precipitation has also increased significantly since 1970, by 12 to 20 percent (Wake, Burakowski, et al., 2014). And extreme precipitation events have resulted in several large floods across New Hampshire. There is a need to address these threats via traditional emergency preparedness and innovative approaches to building individual, organizational, and community resilience. In the future, climate is expected to continue on the trajectory, with an increasing number and temperature of extreme heat days (greater than 90 degrees Fahrenheit). Additionally, average precipitation is projected to increase 17 to 20 percent by the end of the century, primarily in winter and spring, along with the incidence of extreme precipitation events (Wake, Burakowski, et al., 2014). Our older adult population is increasing rapidly, and it is estimated that the proportion of the Region's population that is 65 years and older will increase from 15% to 26% between 2010 and 2040, more rapidly than any other age group (Southwest Region Planning Commission 2015, 19). This demographic shift will have significant implications on housing, transportation, the economy, and health.

Among certain vulnerable populations, such as older adults and those with disabilities, extreme precipitation events, flooding, and storm damage can result in a variety of related health effects or injuries. The events and resulting health problems occur year-round throughout the region in flood-prone and in areas that have not historically experienced such events. The general public has a lack of awareness of the increased frequency and/or intensity of such events which is compounded by misperceptions about resources and supports available during disasters. There are also misunderstandings about the spectrum of health risks and their potential to become worse in the future due to changes in weather and climate. As its uncertain when a major weather event or disaster will occur, and this makes it difficult to engage the public to build and maintain response skills.

1.3 THEORY OF CHANGE

Obviously, we cannot change the weather. We can, however, change the perception of danger and awareness to extreme precipitation events, flooding, and storm damage of certain populations. We can also influence human behavior before, during, and after such events by increasing individual capabilities, confidence, and levels of awareness and sustain that influence by partnering with specific organizations.

Interventions aimed at reducing health risks associated with extreme precipitation events may involve behavior change at individual, organization, and community levels, requiring an understanding of behavior change at multiple stages, often simultaneously (Gland and Bishop, 2010). One theory of the stages of behavior change is the Transtheoretical Model (TTM) (Prochaska & Di Clemente, 1982). The TTM framework has been widely used in health behavior research (Glanz, Rimer, & Viswanath, 2008). It has also framed preparedness interventions related to wildfires in the western U.S. (Martin, Bender, & Raish, 2007), extreme weather and sea level rise in coastal regions of the eastern U.S. (Mundorf, Redding, Prochaska, Paiva, & Rubinoff, 2018), and flood risk in the Netherlands (Bočkarjova, van der Veen, & Geurts, 2009). The Transtheoretical Model identifies 5 stages that an individual (organization, or community) follows to adopt new behaviors: thinking about change (precontemplation); determination to change; preparation for change; action; and maintenance (Prochaska & Di Clemente, 1982; Volz, 2009). Some versions of the model incorporate a sixth stage, relapse (Volz, 2009). The BRACE Plan of Action uses the TTM framework to structure its program objectives and validate its results. The goal of the BRACE program is to increase flood risk awareness and emergency preparedness and reduce health risks associated with extreme precipitation events, particularly with vulnerable populations in Southwest New Hampshire.

The main objective is the adoption of an emergency preparedness plan by older adult populations. An emergency preparedness plan is defined as having: an emergency preparedness kit; an evacuation plan and/or shelter-in-place plan; and a list of emergency phone contacts for notification and help (Mundorf et al., 2018). A pre and post survey using the Transtheoretical Model (Prochaska & Di Clemente, 1982) for emergency preparedness behavior

change will identify a respondent's stage of change before and after the pilot program (Lacey & Street, 2017). Each stage of change is paired with the BRACE Project's educational and behavioral tasks (Volz, 2009), (Table 1). The ultimate goal of this project is to increase the ability of older adults to shelter in place. During the initial phase of this project we will focus on individual-level preparedness. We will build on this work in the future by addressing community- and organizational-level preparedness.

Table 1 - Measuring Emergency Preparedness Using the Transtheoretical Model (Prochaska & Di Clemente, 1982).

Descriptor	Level	BRACE Project Tasks
• I don't need or want to prepare for emergencies. • I know I should prepare for emergencies, but I don't intend to.	Precontemplation	• Explain and personalize the risks during open discussions in EPT seminars and brochures. • Use mass media to highlight risks to seniors and their support systems at the precontemplation stage.
• I intend to prepare an emergency plan within the next 6 months.	Contemplation	• Encourage an evaluation of the pros and cons of preparing for emergencies and for doing nothing during open discussions in EPT seminars.
• I have plans to prepare my emergency plan within the next month.	Preparation	• Encourage action, even in small steps, during open discussions in EPT seminars.
• I am doing something to prepare for emergencies right now. • I have a kit, emergency numbers, or an evacuation plan now.	Action	• Support action and self-confidence for dealing with obstacles. • Reiterate the long-term benefits during open discussions in EPT seminars.
• I adopted an emergency preparedness plan more than 6 months ago and am committed to keeping it current. • I adopted a plan and practiced it at least once.	Maintenance	• Create a plan for follow-up support during EPT seminars. • Encourage persons at maintenance stage to support seniors beginning the process.
• I don't prepare for emergencies anymore. • I used to have a kit and a list of phone numbers, but I don't keep them current anymore.	Relapse	• Reassess motivation and evaluate triggers and barriers during open discussions in EPT seminars.

It is presumed that older adults participating in the BRACE emergency preparedness interventions will be at various stages of change as defined by the Transtheoretical Model.

Some individuals may need flood awareness training, while others may need support in maintaining their emergency preparedness plan (Mundorf et al., 2018). "People must feel they have the knowledge, ability, and resources to deal with the risk at hand and that the actions they take will effectively reduce the risk, before they are ready to move into the action stage of risk reduction." (Martin et al., 2007). A Dutch study on motivation and flood risks concluded that: enhanced motivation of people at the action stage should focus on the costs and benefits of continued action; motivation of people in the contemplation stage should focus on the hazards and consequences of floods and the effectiveness of the proposed actions; motivation of people at the precontemplation stage should focus on the likelihood of floods and flood mitigation; and general communication about flood hazards would increase overall motivation (Bočkarjova et al., 2009). A study in the Northeast concluded that highly-respected individuals in the community served a key role in sustaining adaptive behaviors when the project ended (Keeley, 2012). The BRACE Project will incorporate multiple strategies to empower behavior change and reduce health risks for individuals at varying stages. These tools are described in the logic model.

1.4 LOGIC MODEL

The logic model below lists the activities, target group, and long-term outcomes for each proposed intervention activity (Table 2).

Table 2 - Simplified Logic Model.

Activities to Move Target Audiences to Take Action	Target Groups That Need to Take Action	Long-Term Public Health Outcomes
Create and disperse emergency preparedness kits.	Older adults entirely without or having an emergency preparedness kit that does not completely meet their individual needs.	Increased capabilities and confidence to "shelter in place" and be self-reliant during weather-related emergencies.
Conduct emergency preparedness trainings with older adults.	Older adults unfamiliar with rescue operations protocols and evacuations, preparing for severe weather, contacting appropriate agencies for assistance with medical devices, safe operation of generators and detection of CO, adoption of early warning systems notifications, family preparedness planning.	Increased awareness to existing supports relative to weather-related emergencies as well as increased capabilities to avoid or prevent hazardous situations that may occur during or following a severe weather event.

Activities to Move Target Audiences to Take Action	Target Groups That Need to Take Action	Long-Term Public Health Outcomes
Create a multi-media campaign to support use of kits and trainings and reinforce the need for emergency preparedness.	Media outlets and organizations in direct communication with older adults.	Widespread awareness of health effects associated with extreme precipitation events, flooding, and severe weather as well as appropriate individual responses.

2 ASSESSMENT OF HAZARDS AND HEALTH

2.1 CLIMATE AND WEATHER HAZARDS

The Greater Monadnock Climate and Health Adaptation Plan (Greater Monadnock Public Health Network, 2017) identified a variety of climate and weather-related health hazards resulting from extreme precipitation events and severe weather (Wake, Bucci, & Aytur, 2014). In addition, Southwest New Hampshire has experienced a number of seminal events such as the Alstead floods in 2006, impacts from Hurricane Irene in 2011, and flooding in Keene. The National Climate Assessment has a summary of research on health effects associated with severe precipitation events (USGCRP, 2018) including:

- Effects on mental health that may be long lasting;
- Physical injuries that occur prior, during and after extreme precipitation events;
- Increases in respiratory and diarrheal diseases because of crowding of survivors, often with limited shelter and access to potable water;
- Increased risk of water-related diseases from disruption of water supply or sewerage systems;
- Triggering of allergy and asthma due to indoor water damage and mold growth;
- Substantial indirect health impacts can also occur because of damage to the local infrastructure (such as damage to clinics and roads) and population displacement.

Waterborne disease outbreaks are typically associated with contamination of drinking water supplies. One potential cause of water contamination is flooding, which can contaminate water supplies with oil, gasoline, chemicals, and fecal matter from sewage systems and septic tanks. Bacteria also becomes mobilized during heavy precipitation events, affecting water quality. Private drinking water wells have the highest risk of contamination during flood events, especially wells that are in poor condition (New Hampshire Department of Environmental Services, 2008).

2.2 VULNERABLE POPULATIONS AND TARGET AUDIENCES

As part of the BRACE project, the Southwest New Hampshire built on existing work documented in the Climate and Health Adaptation Plan. The plan described vulnerability as

the function of three important factors: exposure, sensitivity, and adaptive capacity. One group with a heightened vulnerability to the effects of climate change, including extreme precipitation events and severe weather, is older adults. It is important to note that the age of an individual does not define this vulnerability, but rather an increased likelihood of certain characteristics, including medical conditions and impairments, economic limitations, and social isolation (Jason L. Rhoades, 2016, pp. 8–10).

> "Older persons are likely to be disproportionately vulnerable during disasters because they are more likely to have chronic illnesses; functional limitations; and sensory, physical, and cognitive disabilities than are those of younger ages. In addition, they often take multiple medications, rely on formal or informal caregivers for assistance, and, especially at advanced ages, and experience general "frailty." Other factors that increase older persons' vulnerability in emergencies and disasters include living alone and in isolated rural areas." from *We Can Do Better: Lessons Learned for Protecting Older Persons In Disasters*. p. 6. (Gibson and Hayunga, 2006).

3 ASSESSMENT OF INTERVENTIONS

3.1 EXISTING INTERVENTIONS

Emergency preparedness resources are available from local, regional, state, and federal sources, yet they do not often assess community wants and needs, nor support training to at-risk groups. While individual communities in the Region have in place plans and trained volunteers to respond to a disaster or emergency, building personal resilience at home is an ongoing task. Better preparedness should involve attending trainings on this topic, being supported with sample plans and emergency kits, becoming better informed of the types and locations of vulnerable populations living in a community, reaching out to these groups in advance of a disaster or emergency to better understand their needs, and targeted outreach to at-risk populations.

The Greater Monadnock Public Health Network initiated an intervention in 2016 and 2017 to address the health impacts of a changing climate in collaboration with the New Hampshire Department of Health and Human Services via the Centers for Disease Control's Climate and Health Program. An assessment phase explored the major weather hazards in the region, and developed a plan to adapt to these conditions. The intervention phase demonstrated that the project was able to reach out to the target population of older adults, and complete a number of trainings that were evaluated to assess changes in knowledge and confidence to respond. Lessons learned included the need for improved marketing to recruit more attendees, take a multi-impact approach to the interventions via emergency plans & outreach, and develop tools to better evaluation of change. A full report on the project is available.

At the regional level, the Greater Monadnock Public Health Network and partners published a guide in 2014 for healthcare providers and community partners in the Region on

how to prepare at-risk entitled "Tips for Interacting with Vulnerable Populations in Emergencies or Disasters." However, the adoption and awareness of this resources has not been measured. The public health network also routinely convenes the Healthcare Workforce Group and Regional Coordinating Committee on Emergency Preparedness to plan for and share information about ongoing local and organizational emergency preparedness efforts as well as relevant training and planning resources.

At the State level, the New Hampshire Homeland Security and Emergency Management sponsors ReadyNH.gov, an informational education and outreach campaign designed to inform residents on dangers in their area and how they may take action.

At the local level, individual Emergency Management Directors, public safety professionals, are involved in a variety of projects, including: long-range community-wide planning to data gathering on assets and vulnerabilities to educational opportunities and forums.

3.2 LITERATURE REVIEW

A review of the literature produced a mixture of applied interventions, lessons learned, and suggestions for future interventions to reduce health risks associated with extreme precipitation events (Appendix A: Interventions to Increase Flood Risk Awareness and Reduce Health Impacts). Interventions ranged from flood risk and safety awareness (the TTM precontemplation and contemplation stages) to emergency preparedness (the TTM preparation, action and maintenance stages). The results of the flood study in North Dakota clearly demonstrate the success of ongoing emergency preparedness: Fargo, which engages in annual flood mitigation measures, sustained little damage in 2011; Minot, without an annual flood preparedness program, experienced severe damage to infrastructure and the displacement of 11,000 residents (Shultz et al., 2013). The lack of preparation occurred in other countries as well. A Hong Kong study concluded that 78% of elderly residents were unprepared for disasters, having no emergency kit, knowledge of how to turn off utilities or contact their families (Loke, Lai, & Fung, 2012). A majority of residents in the Netherlands were also unprepared. A study on flood risk preparedness in the Netherlands found that majority of residents were in the contemplative and pre-contemplative stages of adopting protective behaviors (Bočkarjova et al., 2009).

A variety of lessons were learned from interventions and extreme weather events. Lessons from Hurricane Katrina included: the need to provide emergency preparedness information to older and disabled populations in formats easily accessible to them; educating vulnerable populations on mandatory evacuations and how evacuation obstacles can be overcome; and the need for emergency supplies, medications, and back-up power in case sheltering in place is the only option during an emergency (Gibson & Hayunga, 2006). Lessons from New England included the need to make information available in a variety of formats, including stories and

visuals, and to build social resilience alongside infrastructure to increase the resilience of the whole socio-ecological system (Keeley, 2012). An increase in emergency preparedness behaviors in Australia was observed after the implementation of a flood evacuation plan (Dufty, 2008). An increase in emergency preparedness behaviors was also found after workshops on emergency preparedness in Spain (Bodoque, Diez-Herrero, Amerigo, Garcia, & Olcina, 2018). Research after Hurricane Katrina emphasized the importance of educating older adults to have an emergency plan and 3-6 days of emergency supplies, an emergency plan and medications in case a "stay-in-place" order be given (Gibson & Hayunga, 2006; Rosenkoetter, Covan, Cobb, Bunting, & Weinrich, 2007).

Suggested interventions to increase flood risk and safety awareness include an annual distribution of flood safety brochures to people living in flood-prone areas and education on health and safety risks associated with floods, including driving through floodwaters (FEMA, 2013). Generalized emergency preparedness suggestions for older adults included having an emergency preparedness kit; a list of phone numbers to call during or after an event; and knowing the local evacuation routes (Brown & Walsh, 2018). Additional interventions include identifying locations for shelters that serve older adults; pilot-testing educational materials and programs prior to an emergency to ensure that the information is accessible and likely to be used during an event; and utilizing older adults as peer educators, models of resilience, emotional support and outreach during or after an event, and to distribute educational materials (Brown & Walsh, 2018).

There were several common themes in the research. Most importantly, increased means of communicating emergency information and warnings to the public are needed, especially to vulnerable populations, including older people, persons with disabilities, and those without a means of receiving information due to a lack of understanding the common language or a lack of physical resources to receive information. Another common theme was the need to tailor information in a variety of visual and oral formats using multiple communication mediums, including mass media, the internet, phone systems, print, and word-of-mouth. Trust was an issue: some studies showed a trust in the media after a devastating event such as Hurricane Katrina (Rosenkoetter et al., 2007), while others demonstrated more trust in local knowledge and social networks (Brockie, 2016). Reasons not to evacuate when ordered were similar to the results of our stakeholder sessions and may be universal: lack of knowledge on what to do or where to shelter (Penning-Rowsell, Tunstall, Tapsell, & Parker, 2007); protection of property and pets; and lack of transportation or mobility (Rosenkoetter et al., 2007). Overall, the research suggests strongly that emergency preparedness communication and education increase risk perception and emergency preparedness behaviors (Table 3, p.17).

4 ASSESSMENT OF COMMUNITY NEEDS

4.1 MEETINGS WITH THE LEADERSHIP COUNCIL FOR A HEALTHY MONADNOCK AND OTHER STAKEHOLDERS

Antioch University New England and Southwest Region Planning Commission planned and facilitated a variety of planning and stakeholder sessions (Appendix B: Synopsis of BRACE Stakeholder Meetings). Feedback from these sessions is incorporated into this report for the purpose of assisting the Leadership Council for a Healthy Monadnock Executive Committee in prioritizing and selecting an intervention to implement. Each stakeholder meeting included a brief introduction to the BRACE project and ample time for each group to participate in open dialogue, ask questions, and provide their ideas and feedback. Examples of questions that were asked at planning sessions and some stakeholder sessions included:

- What were your individual and organizational experiences when protecting the health of vulnerable populations before, during, and after extreme precipitation events?
- What needs have you identified, either for a vulnerable population or a health-based organization, as a result of these experiences?
- What interventions were used? How were they successful? How could they be improved?
- Which locations or populations would you like to see included in the input-gathering sessions that inform our Plan of Action and why?

Examples of questions that were asked at stakeholder sessions with vulnerable populations included prompts around:

- Notification: How are you notified about extreme precipitation events and severe weather (such as flooding)? Are these notifications timely and helpful? Are you signed up to receive early warning notices by phone or email? What is the best way to notify you of extreme precipitation events?
- Health Issues: What health issues have you experienced or witnessed, before, during, or after an extreme precipitation or severe weather event? What concerns do you have for your health before, during, and afterwards?
- Assistance: What kind of help was needed, by you or someone you assisted? Did you or others get the help you needed? Do you or others need help to evacuate? If so, what kind? Do you have someone who can help?
- Preparedness: What kinds of emergency preparedness measures were in place? Were they effective? How could they have been improved? What do you need to be independent during a severe precipitation event? Do you have an emergency

preparedness kit? If yes, what's in it? If no, why not? Would you use one if it was provided?

- Future Services: What programs or tools would you like to have offered to reduce health issues caused by extreme precipitation events and severe weather?

4.2 Opinions Surveys or Other Information

4.2.1 Healthy Monadnock 2017 Community Survey

While no opinion surveys were conducted specifically for the BRACE project, the 2017 Healthy Monadnock Community Survey conducted by the University of New Hampshire Survey Center indicated particular needs around emergency preparedness education and adoption of emergency preparedness kits (The Survey Center University of New Hampshire, 2017). Nearly two-thirds of respondents believe first-responders would reach them within several hours if a major disaster were to happen in their community (and 2 in 5 believed responders would arrive and provide assistance within one hour). The three demographics including: age 65 and older, annual income less than $15,000, and retired were more likely to say responders would arrive in less than one hour compared to all respondents.

The same survey found that less than half of respondents had all of the listed items included in an emergency preparedness plan (including two days of food and water, a flashlight, a portable radio and spare batteries, emergency phone numbers, and a meeting place for family members in case of evacuation).

4.2.2 Local Emergency Operations Planning

Through our partnership with the BRACE project, the Southwest Region Planning Commission staff developed an overview of local emergency operations plans. The process provided allowed the project staff and partners to better understand the weather hazards present in the region. It also allowed staff to better understand existing needs and practices (e.g. training and outreach) to consider as part of a public health intervention focused on emergency preparedness to be implemented in 2019 (Appendix E: An Overview of Local Emergency Operations Planning In New Hampshire). Although the plans do not contain specific actions focused on extreme precipitation events and severe weather, they do include mention of a variety of strategies to support emergency preparedness accepted locally as best-practices. The goal of the BRACE framework is to assess local weather hazards with an eye on changing climate, assess health impacts (or risky/protective behaviors), and assess evidence-based interventions that fit community needs, put a plan-of-action into effect, and evaluate any changes. Although these BRACE steps don't mesh perfectly with the LEOP goals, the intervention can teach people to better prepare for working with responders in an actual disaster scenario.

4.2.3 Local Hazard Mitigation Planning

Hazard Mitigation plans are required by FEMA to be updated every five years for town and cities in the United Stated to remain eligible for mitigation funding. The plan updates are

funded by FEMA and have a requirement of a match that is typically handled via in-kind services through attendance at the Hazard Mitigation Committee meetings to assist with the information to be used in the plan.

Hazard Mitigation Plan updates are generally structured alike and must meet certain criteria to be formally approved by FEMA. Much of the plan consists of information that is used to develop strategies and an implementation plan to carry out the strategies within a timely manner.

Of particular interest to the BRACE project is the Risk Assessment and the Vulnerability Assessment that is within each plan. The Risk Assessment is a matrix that includes all of the potential hazards that the community is concerned about. The Local Hazard Mitigation Committee participates in an exercise that looks at each potential hazard, and provides a group consensus on a rating for *Human Impact*, *Property Impact, Business Impact, and Probability of Occurrence*. From those ratings, the *Severity* and *Risk* are calculated.

The Vulnerability Assessment is an assessment of the potential areas for each of the hazards to occur. The Local Hazard Mitigation Committee determines how many structures could be impacted if a disaster occurred. The potential losses are then calculated based on the median home value in that town, or on individual assessments if committee determines that the structures should be considered by their actual assessed value, such as businesses. In these assessments, only the value of the structure is considered, and not property, building contents, or human impact.

The assessment of local vulnerability to flooding, tornadoes, high winds, downbursts, hurricanes & tropical storms, severe winter weather, and dam failure provide both an opportunity to target municipalities for the implementation of public health interventions as well as provide potential strategies for future hazard mitigation plan updates (Table 5, p. 33).

5 PROPOSED INTERVENTION

The proposed intervention strategies were chosen based on our assessment of needs, engagement with community partners, and the strength-of-evidence in the research literature. The three (3) strategies include:

1. Conduct a group training to support individual-level competence in emergency preparedness via a lecture format to at-risk older adults, their caretakers, and older adult agency staff; and,
2. Conduct a group training to support individual-level competence in the writing and use of emergency plans, and the maintenance of home emergency preparedness kits (same target audience as above);
3. Conduct a multi-media public outreach campaign to support community-level acceptance of emergency preparedness via effective messages on the need for training, home plans, and home disaster kits.

We believe this combination of intervention strategies are a complementary approach to reduce the health risks related to extreme precipitation events and severe weather via a change in behavior, change in competence, and change in awareness. The proposed intervention is appropriate for our at-risk community at the present time based on the following criteria:

- Is a short-term solution to an existing health threat.
- Makes use of existing resources and assets.
- Supports a regional health priority around emergency preparedness.
- Focuses on promoting best practices and empowering organizational assets to reinforce the protective behaviors with their members.
- Continues a broader conversation with individuals about other climate or weather-related health problems they may be concerned with or are already experiencing.
- Emphasizes prevention of a variety of dangers that may occur throughout the year and throughout the region.
- Aligns with and serves as a potential model for local emergency management and hazard mitigation planning initiatives.

6 Work Plan – Goals, Objectives & Activities

See *Appendix C: Work Plan*.

7 Conclusion & Next Steps

The planning phase of the BRACE project in Southwest New Hampshire benefited significantly from the volume of personal and organization experiences pertaining to emergency preparedness shared through the planned stakeholder sessions. Even with the number of sessions held, it was clear there was interest on behalf of participants in continuing a dialog about climate and weather hazards in our region. In addition to assisting project partners document past experiences and strategies, as well as current needs, the stakeholder session approach was also successful in identifying resources, venues, and organizations to consider during an intervention. During 2019, project partners will continue to foster these relationships through the implementation of the proposed intervention strategies.

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9 APPENDIX A: INTERVENTIONS TO INCREASE FLOOD RISK AWARENESS AND REDUCE HEALTH IMPACTS

Table 3 - Interventions to Increase Flood Risk Awareness and Reduce Health Impacts.

Author & Year	Title	Intervention	Results
Bodoque et al., 2018	Enhancing flash flood risk perception and awareness of mitigation actions through risk communication: A pre-post survey design	Emergency preparedness	Flood risk communication in Spain increased social resilience. Workshops on emergency preparedness and flood risk increased perceived risk and perception and prepared residents for flood events.
Eckert et al., 2018	Health-Related Disaster Communication and Social Media: Mixed-Method Systematic Review	Early warning & emergency preparedness communication	Research is needed on who is and needs to be reached via social media. Agencies need to incorporate social media into daily operations before crises occur to build familiarity and trust.
Moreno, Lara, & Torres, 2018	Community resilience in response to the 2010 tsunami in Chile: The survival of a small-scale fishing community	Emergency preparedness	The community's social resilience, including local knowledge, trust, and sense of community sustained residents after the disaster until emergency help arrived, despite inadequate food, water, clothing, and medicine.
Mundorf et al., 2018	Resilience and Thriving in Spite of Disasters: A Stages of Change Approach	Emergency preparedness (pilot study)	Individualized online communication combined with community meetings encouraged respondents move toward storm preparedness. Longitudinal studies are necessary to evaluate the long-term effectiveness of communication interventions.

Author & Year	Title	Intervention	Results
Stephenson, Vaganay, Coon, Cameron, & Hewitt, 2018	The role of Facebook and Twitter as organisational communication platforms in relation to flood events in Northern Ireland	Early warning	A comparison of Twitter and Facebook revealed that Twitter broadcast more information during the response stage, while Facebook generated twice as many references to floods during the preparedness stage. Facebook also encouraged more behavioral responses than Twitter.
Teo, Goonetilleke, Ahankoob, Deilami, & Lawie, 2018	Disaster awareness and information seeking behaviour among residents from low socio-economic backgrounds	Emergency preparedness	Australian residents rely on TV for disaster-related news despite the use of social media. Persons from low socio-economic backgrounds with English language deficiencies struggled to find news sources. Disaster awareness was higher for women than men with higher socio-economic backgrounds.
Brockie, 2016	"What doesn't kill us" – the experience of older adults evacuated during the 2011 and 2013 Brisbane floods	Emergency preparedness	Participants preferred to use TV, radio, and word of mouth over newer technologies for emergency information. Decisions related to evacuation and recovery measures were based on members of their social networks and not mass media.
Beier, Brzoska, & Khan, 2015	Indirect consequences of extreme weather and climate events and their associations with physical health in coastal Bangladesh: a cross-sectional study	Health risks & emergency preparedness	Higher likelihood of disease in women and elderly, unsafe drinking water, river erosion, food scarcity, and loss of income as a result of flooding. Recommendations included interventions that raised flood risk awareness and education to reduce health impacts associated with severe weather.
Morris, Mueller, & Jones, 2014	Use of social media during public emergencies by people with disabilities	Early warning	Deaf respondents were more likely to use social media to receive, verify, and share emergency information. Multiple media sources are needed to reach the entire community.

Author & Year	Title	Intervention	Results
Shultz et al., 2013	Mitigating flood exposure	Emergency preparedness & early warning (case study)	Fargo (ND) successfully mitigated the physical and psychological effects of the 2011 flood through an active flood risk reduction program while 11,000 residents in Minot were displaced. Recommendations included adding prevention and preparedness to response and recovery efforts in risk reduction programs.
Taaffe, Garrett, huang, & Nkwocha, 2013	Communication 's Role and Technology Preferences during Hurricane Evacuations	Early warning	TV used the most to receive information in Charleston SC; cell phones outnumber landlines so reverse 911 may not be effective to warn majority of residents; radio & cell phones used for traffic information (traffic congestion during evacuation); more research is needed.
Keeley, 2012	Preparing for climate change in three New England coastal communities: Lessons on motivations, approaches, and outcomes	Emergency preparedness for extreme weather events in changing climate (case study)	Lessons learned included: integrate EP with existing activities; know the community; engage a wide range of stakeholders; make information available in multiple formats & include visuals & stories of vulnerabilities & adaptations; focus on strategies to improve resiliency of whole socio-ecological system.
Loke et al., 2012	At-home disaster preparedness of elderly people in Hong Kong	Emergency preparedness	Majority of elderly (78%) not prepared for disasters: 22% had emergency pack, knew how to turn off utilities and contact family. Public alert systems, disaster preparedness booklets, and emergency needs lists were recommended.
Bočkarjova et al., 2009	A PMT-TTM model of protective motivation for flood danger in the Netherlands	Flood risk perception	Majority of population not actively protecting themselves from flood risks; need to communicate flood risk & costs of protective action to targeted populations or regions most likely to adopt measures.

Author & Year	Title	Intervention	Results
Dufty, 2008	A new approach to community flood education	Emergency preparedness	Results of a pre and post implementation of the Maitland flood education plan based on education, mitigation, lessons, and building adaptive capacity & resiliency found an increase in concern, preparedness, and understanding of appropriate response behaviors by Australian residents.
Penning-Rowsell et al., 2007	The Benefits of Flood Warnings: Real But Elusive, and Politically Significant	Early warning & emergency preparedness	Stress from UK floods was exacerbated by lack of warning, contaminated water, lack of help and advice on what to do' lack of knowledge of shelter locations, and lack of empathy from government, service agencies, and society.
Rosenkoetter et al., 2007	Perceptions of Older Adults Regarding Evacuation in the Event of a Natural Disaster	Risk perception & emergency preparedness	Willingness to evacuate was based on trust in officials and the media: 80% would evacuate after hearing stories of Hurricane Katrina. Reasons to not evacuate included: property protection; pets; nowhere to go; no transportation; foot & leg problems. Due to the high incidence of chronic illness, it was suggested that people in flood-prone areas have an emergency plan with a kit and information on important contacts and shelters. "This kind of anticipatory guidance is a definitive public health intervention."
Gibson & Hayunga, 2006	We Can Do Better: Lessons Learned for Protecting Older Persons in Disasters	Emergency preparedness	Lessons learned included: the need to provide EP information to older adults in accessible formats; educate older adults about evacuation orders & sheltering in place with 3-6 days of food, water, medicine, and back-up power.

10 APPENDIX B: SYNOPSIS OF BRACE STAKEHOLDER MEETINGS

Table 4: Synopsis of BRACE Stakeholder Meetings.

Group	Date	Comments & Concerns
Leadership Council for a Healthy Monadnock Executive Committee	10/2/2018	How to contact emergency personnel when power outage to have them come to work when no cell service; Events often occur when people are at work--business community needs to be connected to the system; What happens to fire alarms when no power? Is there a code system for areas to alert emergency personnel?; target meals on wheels, people who don't travel & flooded towns; Focus on vulnerable populations to educate on how to not be vulnerable
City of Keene Energy & Climate Committee	10/3/2018 & 11/6/18	Will interventions be incorporated into the hazard mitigation plans? Doing so would add to channels of city response & communication; how to facilitate information sharing & access to electricity for medical devices; Monadnock at Home has list of contractors for seniors to hire for mold & other issues after severe events
Monadnock Area Fire Chief's Association	10/25/2018	"No one identifies as having needs until a problem occurs"; Generators and drinking water biggest issues of ice storm; Notification and database most critical (boil water order); Most floods = no notice events; "Part of notification can be stay where you are"; Preventive education—turn around don't drown
EMS Fire Chiefs	10/30/2018	Swanzey uses Code Red for call to all phones in town and all cell phones passing through town—can be targeted to neighborhoods and streets; let PCP talk to 1st responders; no shelters for people with pets; construct resource (supplies) list for towns/EMS; "teach people how to not be victims so we don't have to rescue them"; "back-up heat, food, disaster kits, snow tires, sealed storage containers—that's what people don't have"
Monadnock Region Coordinating Council & Healthcare Workforce Group	11/8/2018	Nelson—small town emergency cards—handed out signs to put up saying okay or need help—not sure who tied into card system—handed out after ice storm & floods--not used yet—built community facility to cook & wash clothes at fire station—has power if town is without; Eversource--Educate the public so they will not jam the phones & all report the same thing—need to know what is being done 1st

Group	Date	Comments & Concerns
Monadnock at Home	11/15/2018	hear of events from tv, radio, phone but MOW not available weekends or holidays; "A lot of people don't have back-up generators for oxygen."; Communication seems to be key—finding out who needs help—oxygen—can't always get some in advance; Biggest need—knowing who's vulnerable & getting information to them rather than having the tools available—know what's going on right now—during & after event—hooking some people up with people to live with
Cheshire Village at Home	11/29/2018	"it's very hard to know where to turn; if you don't have power you don't know where to go, what to do"; "If each town had a gathering place with a bulletin board to post what to do, where to go—it's the old-fashioned way to communicate—Stoddard has the town hall, Keene has the library and fire station—communication during these events is lacking"; "planning—that's what it's all about—you can't wait until it's happening to get the word out—Cheshire Village at Home/Monadnock at Home could prepare a paper: 'if this happens do this, if this happens do that'"; "Having a list of people to contact for residents/members beyond their own town would be most helpful—for power outage, or flood, or in crisis—I don't know who to call—police or fire? What are the options & circumstances to be prepared for when an event occurs?"
Hinsdale Friendly Meals	11/30/2018	"How do we find out where emergency centers are?"; "You mean the police department won't give a list of people and numbers needing help?"; Meals on Wheels people dependent on people to bring food & prescriptions-—"Somebody needs to know who they are—those that need help."
Keene Friendly Meals	12/4/2018	"What convinced me to leave my house was a boat came by my window."; "Have you addressed shelters in Keene where people can go?"; "Sometimes you have neighbors who will look out for you."; hear of events from phone if near phone or look out window; a lot of people have no cars—have walkers, wheelchairs, etc.—need assistance to evacuate; in rural areas wells get contaminated—where to get water if well contaminated?; "They need support at the time of the event."; "I don't know who to call to get help."

11 APPENDIX C: WORK PLAN

Goal	Reduce the health risks before, during, and after extreme precipitation events and severe weather on vulnerable populations, including older adults.
Objective 1: Train on Emergency Preparedness	Project staff will use a set of education strategies in a group lecture format to reach up to 100 older adults in the Monadnock Region in order to increase both their knowledge of health risks and engagement in protective actions associated with extreme weather and precipitation events by June 30, 2019.

Strategic Approach	***Evaluation***
STRATEGY 1: Use a lecture or workshop-style educational intervention with verbal and visual information to increase knowledge of risky and protective actions related to extreme precipitation events.	Written pre and post survey of emergency preparedness knowledge (including questions on emergency preparedness kits, emergency preparedness planning best practices, and the use of available educational materials from relevant agencies and organizations. Pre and post surveys should contain questions related to TTM stage of change to demonstrate change in preparedness behaviors; types of knowledge retained and used; and educational materials including media sources that served as reminders for safe behaviors.
STRATEGY 2: Distribute printed educational materials to increase knowledge of health risks and personal protective actions.	Written pre & post pilot survey, phone call, or in-person meeting.

Objective 1: Train on Emergency Preparedness	Project staff will use a set of education strategies in a group lecture format to reach up to 100 older adults in the Monadnock Region in order to increase both their knowledge of health risks and engagement in protective actions associated with extreme weather and precipitation events by June 30, 2019.

STRATEGY 1: Use a lecture or workshop-style educational intervention with verbal and visual information to increase knowledge of risky and protective actions related to extreme precipitation events.

Activities	Short-term Performance Targets	Intermediate or Longer-Term Performance Targets
• One 90-minute intervention with presentations, slideshow with printed handout, and group discussions by project partners & guests. 3 topic areas: preparing for extreme precipitation events with emergency kits; early warning messages; how to stay safe & informed during and after events. Includes list of items to maintain in emergency kits and gift of kit to each attendee (strategy 3), presentation and instructions on signing up for emergency messages or loading apps onto cell phones, and emergency contact list of local service agencies. • Conduct 2-4 one-time trainings designed to increase knowledge and reduce health risks associated with extreme precipitation events before March 31.	• Convene group to select and customize curriculum from available options (including 2017 Greater Monadnock Public Health Network intervention). • Publicize seminars via 4 target agencies (Cheshire Village at Home, Meals on Wheels, Monadnock at Home, Keene Senior Center). • Conduct 5-10 tests of how to create a home emergency plans, and how to use kits, with older adults living alone (via MOW). • Conduct post survey in May for piloted older adults to determine knowledge, use of materials, and adopted behaviors (mail? 2nd meeting to talk about program? via phone?)	• Increase the number of attendees/fact sheets or toolkits delivered • Replicate program at larger community level to increase resilience of older adults throughout Monadnock Region by 2020 • Increase number of area service agencies involved with building resilience of older adults against the effects of climate change • Re-evaluate the effectiveness of short-term interventions and the adaptation of long-term behavior changes to reduce health risks associated with extreme precipitation events via surveys of population, service agencies & project partners.

Objective 1: Train on Emergency Preparedness	Project staff will use a set of education strategies in a group lecture format to reach up to 100 older adults in the Monadnock Region in order to increase both their knowledge of health risks and engagement in protective actions associated with extreme weather and precipitation events by June 30, 2019.

STRATEGY 2: Distribute printed educational materials to increase knowledge of health risks and personal protective actions related to extreme precipitation events.

Activities	Short-term Performance Targets	Intermediate or Longer-Term Performance Targets
• Fact sheets include emergency kit contents, dealing with contaminated water, safe generator use, blank form for personal medical information and emergency contact information for emergency kit, etc. • Consider creating project component for promoting " supplemental ALI" through E911 and flood insurance	• Convene group to select materials from available options (including the 2017 Greater Monadnock Public Health Network intervention). • Conduct post survey in May for piloted older adults to determine knowledge, use of materials, and adopted behaviors (mail? 2nd meeting to talk about program? via phone?)	• Increase the number of attendees/fact sheets or toolkits delivered • Replicate program at larger community level to increase resilience of older adults throughout in Southwest New Hampshire. • Increase number of area service agencies involved with building resilience of older adults against the effects of climate change • Re-evaluate the effectiveness of short-term interventions and the adaptation of long-term behavior changes to reduce health risks associated with extreme precipitation events via surveys of population, service agencies & project partners.

Goal	Reduce the health risks before, during, and after extreme precipitation events and severe weather on vulnerable populations, including older adults.
Objective 2: Train on Emergency Plans	Project staff will use a set of education strategies in a group lecture format to reach up to 100 older adults in order to increase both their knowledge of personal and family emergency preparedness plans and engagement in use of a home disaster kit associated with extreme weather by June 30, 2019.

Strategic Approach	***Evaluation***
STRATEGY 1: Use a lecture or workshop-style educational intervention with verbal and visual information to increase knowledge of how to create and use home emergency plans and kits.	Written pre and post survey of emergency preparedness knowledge (including questions on emergency preparedness kits, emergency preparedness planning best practices, and the use of available educational materials from relevant agencies and organizations.
STRATEGY 2: Distribute pre-package disaster kits to 50 participants in training classes (who request them) and 50 at-risk elders living alone (via meals on wheels) in order to increase the ability to survive three days without help. Contents of the kit may contain needed items such as coupons or donations of batteries, flashlight, battery-powered radio, canned goods and opener, bottled water, blanket, basic first aid kit, toiletries, and plastic water-tight storage container for contents.	Written pre & post pilot survey, phone call, or in-person meeting.
STRATEGY 3: Distribute and fill-in emergency preparedness plans to all 100 participants in training classes and to the 50 at-risk elders living alone. Contents may include: checklist of items to purchase, replenish or update; list of area resources for assistance; instructions on subscription to early warnings and emergency alerts; emergency contact numbers, pre-planned evacuation locations, and medications list.	In-person or telephone follow-up initiated by recipients of the kit or project partner.

Objective 2: Train on Emergency Plans	Project staff will use a set of education strategies in a group lecture format to reach up to 100 older adults in order to increase both their knowledge of personal and family emergency preparedness plans and engagement in use of a home disaster kit associated with extreme weather by June 30, 2019.

STRATEGY 1: Use a lecture or workshop-style educational intervention with verbal and visual information to increase knowledge of how to create and use home emergency plans and kits.

Activities	Short-term Performance Targets	Intermediate or Longer-Term Performance Targets
• One 90-minute intervention with presentations, slideshow with printed handout, and group discussions by project partners & guests. 3 topic areas: preparing for extreme precipitation events with emergency kits; early warning messages; how to stay safe & informed during and after events. Includes list of items to maintain in emergency kits and gift of kit to each attendee (strategy 3), presentation and instructions on signing up for emergency messages or loading apps onto cell phones, and emergency contact list of local service agencies. • Conduct 2-4 one-time trainings designed to increase knowledge of how to create and use home emergency plans and kits.	• Convene group to select and customize curriculum from available options (including 2017 Greater Monadnock Public Health Network intervention). • Publicize seminars via 4 target agencies (Cheshire Village at Home, Meals on Wheels, Monadnock at Home, Keene Senior Center). • Conduct 5-10 tests of how to create a home emergency plans, and how to use kits, with older adults living alone (via MOW). • Conduct post survey in May for piloted older adults to determine knowledge, use of materials, and adopted behaviors (mail? 2nd meeting to talk about program? via phone?)	• Increase the number of attendees/fact sheets or toolkits delivered • Replicate program at larger community level to increase resilience of older adults throughout Monadnock Region by 2020 • Increase number of area service agencies involved with building resilience of older adults against the effects of climate change • Re-evaluate the effectiveness of short-term interventions and the adaptation of long-term behavior changes to reduce health risks associated with extreme precipitation events via surveys of population, service agencies & project partners.

Objective 2: Train on Emergency Plans	Project staff will use a set of education strategies in a group lecture format to reach up to 100 older adults in order to increase both their knowledge of personal and family emergency preparedness plans and engagement in use of a home disaster kit associated with extreme weather by June 30, 2019.

STRATEGY 2: Distribute pre-package disaster kits to 50 participants in training classes (who request them) and 50 at-risk elders living alone (via meals on wheels) in order to increase the ability to survive three days without help. Contents of the kit may contain needed items such as coupons or donations of batteries, flashlight, battery-powered radio, canned goods and opener, bottled water, blanket, basic first aid kit, toiletries, and plastic water-tight storage container for contents.

Activities	Short-term Performance Targets	Intermediate or Longer-Term Performance Targets
• Compile or source disaster kits using available funding. • Provide instruction on use and maintenance of kits at in-person training opportunities.	• Conduct 5-10 tests of how to create a home emergency plans, and how to use kits, with older adults living alone (via MOW). • Conduct post survey in May for piloted older adults to determine knowledge, use of materials, and adopted behaviors (mail? 2nd meeting to talk about program? via phone?)	• Increase the number of individuals with access to an emergency preparedness kit. • Replicate program at larger community level to increase resilience of older adults throughout Monadnock Region by 2020. • Re-evaluate the effectiveness of short-term interventions and the adaptation of long-term behavior changes to reduce health risks associated with extreme precipitation events via surveys of population, service agencies & project partners.

Objective 2: Train on Emergency Plans	Project staff will use a set of education strategies in a group lecture format to reach up to 100 older adults in order to increase both their knowledge of personal and family emergency preparedness plans and engagement in use of a home disaster kit associated with extreme weather by June 30, 2019.

STRATEGY 3: Distribute and fill-in emergency preparedness plans to all 100 participants in training classes and to the 50 at-risk elders living alone. Contents may include: checklist of items to purchase, replenish or update; list of area resources for assistance; instructions on subscription to early warnings and emergency alerts; emergency contact numbers, pre-planned evacuation locations, and medications list.

Activities	Short-term Performance Targets	Intermediate or Longer-Term Performance Targets
• Identify emergency preparedness plan template. • Provide instruction on how to complete and practice an emergency preparedness plan at in-person training opportunities. • Identify target guidance/checklist for residents and homeowners specific to older adults (e.g. Ready.gov, ARC, FEMA, DisasterAssistance.gov, CDC "Ready Now!", APHA) • Distribute emergency kits during training seminars in March to 100 piloted older adults affiliated with Cheshire Village at Home, Meals on Wheels, Monadnock at Home, Keene Senior Center, with instructions on use and maintenance of kit.	• Conduct post survey in May for piloted older adults to determine knowledge, use of materials, and adopted behaviors (mail? 2nd meeting to talk about program? via phone?)	• Increase the number of individuals with a personal or family preparedness plan. • Replicate program at larger community level to increase resilience of older adults throughout Monadnock Region by 2020. • Re-evaluate the effectiveness of short-term interventions and the adaptation of long-term behavior changes to reduce health risks associated with extreme precipitation events via surveys of population, service agencies & project partners.

Goal	Reduce the health risks before, during, and after extreme precipitation events and severe weather on vulnerable populations, including older adults.
Objective 3: Multimedia Campaign	Project staff will use a set of education strategies in a multi-media format to reach up to 1000 older adults in order to increase both their knowledge of home emergency preparedness plans and engagement in use of a home disaster kit associated with extreme weather by June 30, 2019.

Strategic Approach	***Evaluation***
STRATEGY 1: Compile a multi-media information campaign to support the creation of messages that are specific to older adults or those at-risk (e.g. disabled, limited, etc.) and specific to a particular media channel.	Written pre and post survey of emergency preparedness knowledge (including questions on emergency preparedness kits, emergency preparedness planning best practices, and the use of available educational materials from relevant agencies and organizations.
STRATEGY 2: Distribute public service materials to one or more specific media channel in the Monadnock Region • for publication on print media or newspapers targeting older adults • for broadcast on radio and/or TV • for distribution on social media communities	Social media hits (quantitative) and comments (qualitative) from on-line media outlets and on-line communities like Facebook or Twitter.

Objective 3: Multimedia Campaign	Project staff will use a set of education strategies in a multi-media format to reach up to 1000 older adults in order to increase both their knowledge of home emergency preparedness plans and engagement in use of a home disaster kit associated with extreme weather by June 30, 2019.

STRATEGY 1: Compile a multi-media information campaign to support the creation of messages that are specific to older adults or those at-risk (e.g. disabled, limited, etc.) and specific to a particular media channel.

Activities	Short-term Performance Targets	Intermediate or Longer-Term Performance Targets
• Create content (including instructions) and messaging for local newsletter articles, websites, e-mail lists, and announcements	• Convene group and or/consultant(s) to select and customize fact sheet from available options	• Replicate program at larger community level to increase resilience of older adults throughout Monadnock Region by 2020. • Re-evaluate the effectiveness of short-term interventions and the adaptation of long-term behavior changes to reduce health risks associated with extreme precipitation events via surveys of population, service agencies & project partners.

Objective 3: Multimedia Campaign	Project staff will use a set of education strategies in a multi-media format to reach up to 1000 older adults in order to increase both their knowledge of home emergency preparedness plans and engagement in use of a home disaster kit associated with extreme weather by June 30, 2019.

STRATEGY 2: Distribute public service materials to one or more specific media channel in the Monadnock Region

- for publication on print media or newspapers targeting older adults
- for broadcast on radio and/or TV
- for distribution on social media communities

Activities	Short-term Performance Targets	Intermediate or Longer-Term Performance Targets
• Work with CodeRED and ReadyNH representatives to determine existing outreach methods and materials. • Create content (including instructions) and messaging for local newsletter articles, websites, e-mail lists, and announcements • Determine outlets to implement social messaging campaign versions of guidance (listed in activities), changes to messaging, and methods to promote additional subscription. • Develop baseline questions to measure existing awareness. • Get commitment to distribute printed and electronic information.	• Distribute fact sheets and public service announcements to multiple media outlets in the Monadnock Region, including radio, television, newspapers, area service agencies for website publication. Information to include: how to build your own emergency kit; avoiding contaminated water and belongings after a flood; safe generator use; "turn around, don't drown" driving tips; power outage safety tips, etc. Include cover letter requesting documentation of each material publicized with dates, times, and mediums where applicable.	• Increase the number of fact sheets or toolkits delivered • Increase number of area service agencies involved with building resilience of older adults against the effects of climate change • Number of subscribers before and after initiative • Number of toolkits • Number of downloads of toolkit resources • Increase in awareness of value/utility of CodeRED • Increase capacity of communities to make effective use of CodeRED during extreme precipitation events • Replicate program at larger community level. • Re-evaluate the effectiveness of media messages via surveys of population.

12 Appendix D: Local Hazard Mitigation Plan Vulnerability Assessment Summary

Table 5 - Local Hazard Mitigation Plan Vulnerability Assessment Summary.

Town	Date	Flooding	Tornadoes, High Winds, Downbursts	Hurricanes and Tropical Storms	Severe Winter Weather	Dam Failure
Alstead	2017	Very High	High	High	Very High	Low
Antrim	2016	Medium	High	High	High	Medium
Bennington	2015	Medium-High	High	High	High	Low-Medium
Chesterfield	2016	High	High	High	High	Low
Dublin	Not on File					
Fitzwilliam	2018	Low	Low	Medium	Medium	Low
Gilsum	2017	Very High	High	High	Very High	(Not Included)
Greenfield	2014	Medium-High	High	Medium-High	High	Low-Medium
Greenville	2015	Low-Medium	Low-Medium	Medium	Medium	Low
Hancock	2017	Medium	Medium	Medium	Medium	Very Low
Harrisville	2017	Low	High	Low	Medium	Low
Hinsdale	2015	Medium	Medium-High	Medium-High	Medium-High	Medium-High
Jaffrey	Not on File					
Keene	2018	Very High	High	Very High	High	Low
Langdon	2018	Low	Medium	Medium	Medium	Very Low
Marlborough	2015	Medium-High	Medium	Medium	Medium	High
Marlow	2013	Low-Medium	Low	Low-Medium	Medium	Medium
Nelson	2019	Low	Very High	High	Very High	Very Low
New Ipswich	2018	Medium	Low	Low	Medium	Medium
Peterborough	2010	High	High	Medium	High	Medium
Richmond	2016	Low	HIgh	High	High	Low-Medium
Rindge	2013	Low-Medium	Low-Medium	Medium	Medium-High	Low-Medium
Roxbury	2017	Medium	Low	High	High	Medium
Sharon	2016	Low	Medium	Medium	High	
Stoddard	2019	High	High	High	High	High
Sullivan	2016	High	High	Medium	Medium	
Surry	2016	Medium	Medium	Medium	High	Low
Swanzey	2016	Medium-High	Low-Medium	Medium	Medium	Low-Medium
Temple	2015	Low-Medium	Low-Medium	High	Medium	Low-Medium
Troy	2019	Low	High	Low	Moderate	Low
Walpole	2018	Medium	Medium	Medium	Medium	Medium
Westmoreland	2016	Medium	Medium	Medium	Medium	Low
Winchester	2017	Very High	Low	Medium	High	Very High
Windsor	2016	Low	Low	Low	Low	Low

13 APPENDIX E: AN OVERVIEW OF LOCAL EMERGENCY OPERATIONS PLANNING IN NEW HAMPSHIRE

Through the Monadnock Region Building Resilience Against Climate Effects (BRACE) project, Southwest Region Planning Commission staff developed the following overview of **local emergency operations plans** to better understand existing needs and practices to consider as part of a public health intervention focused on emergency preparedness to implement in 2019:

Disasters and emergencies happen; it is important for communities to have a coordinated emergency response effort in order to reduce or alleviate losses of life, injuries, and property damage resulting from natural (including flooding and severe weather) and human-made disasters (including civil disturbances and hazardous materials incidents). Emergency responders need to know what has to happen during an emergency and who will do it, in order to prevent duplication of efforts, conflicting efforts, and overlooking critical tasks.

Emergency Operations Planning plays a critical role in coordinating the local emergency response effort. The purpose of Emergency Operations Planning is to initiate, coordinate, and sustain an effective local response to perceived, potential or actual disasters or emergencies by providing strategic and operational guidance for the delivery of emergency management assistance. The local response effort also needs to have the ability to integrate and work successfully with other communities, state and federal agencies, and the private sector.

The Local Emergency Operations Plan (LEOP) provides this structure and process, helping communities to efficiently and effectively respond to emergencies. LEOPs are composed of a Basic Plan, Emergency Support Functions, and additional Annexes and Appendices. The Basic Plan outlines situation and planning assumptions, roles and responsibilities, concepts of operation, continuity of government, training and exercises, administration, plan development and maintenance, and supporting documents. The Emergency Support Functions describe the responsibilities and general concepts for emergency management activities and obligations maintained by each individual function. These responsibilities include reduction of the immediate hazard, saving lives and property, incident stabilization, environmental and economic conservation and restoration of pre-incident conditions. Additional annexes and appendices may cover specific incidents or hazards of concern, or provide additional relevant and/or more detailed supporting information for the LEOP.

Towns update their LEOPs every 5 years to remain eligible for certain emergency grants through New Hampshire Homeland Security and Emergency Management (NH HSEM). LEOP update committees typically consist of emergency responders, road agents, elected leaders and others. It is important to have the town staff and officials typically involved in response efforts at the table when developing the LEOP. They provide valuable insight into the plan's development, and it is an opportunity for those individuals to get re-familiarized with the plan.

LEOPs do not contain specific actions focused on flooding events and severe weather (such as "Municipal Guidance for Flood Emergencies" included in Vermont Emergency Management Plans). Although a minority choose to, they are also not required to identify or map specific vulnerable or high-risk populations and only do so in general categories of "critical facilities" (such as elderly housing, schools, etc.). Instead, they emphasize responses applicable to a variety of functional types of assistance referred to as Emergency Support Functions.

However, themes and practices present in LEOPs include mention of a variety of themes focused on personal preparedness, early warning systems and resources applicable to extreme precipitation events, flooding, and severe weather:

Personal and Family Preparedness:

Individuals and households have a responsibility to be prepared for disaster situations. The ReadyNH.gov website contains many emergency preparedness resources for local residents. These include signing up for emergency alerts through NH Alerts, preparing an Emergency Contacts card, compiling an Emergency Kit, and developing a Family Emergency Plan. Residents should also educate themselves on what to do before, during, and after different types of disasters.

Training for Local Emergency Response Personnel:

Training is designed to develop the knowledge, skills and abilities required in a disaster or emergency. Basic training that is recommended and provided includes ICS fundamentals and LEOP orientation. Exercises are conducted to evaluate plans and procedures used during actual emergencies and identify the need for Plan modifications and/or additional training. When properly integrated, training and exercising can improve the response and the delivery of emergency/disaster assistance to residents and visitors. Many communities rely on training and exercise opportunities provided by FEMA and NH HSEM.

Early Warning Systems and Notification:

Immediate notification to the general public of an imminent or actual emergency is an essential function of government and this capability must be maintained. Methods of alerting the public include:

- Outdoor Warning Devices (sirens, air whistles, loudspeaker-equipped vehicles, etc.)
- Door-to-door Canvassing
- NOAA Weather Radios
- Emergency Alert System
- Local Radio & TV stations
- Cable TV Systems
- Word-of-Mouth by friends, relatives, and/or neighbors
- Social Media/Mobile phone technologies

The following is a list of the means available to communities for transmitting/disseminating emergency public information messages:

- Emergency Alert System (EAS)
- Television
- Radio
- Newspaper
- Reverse 911
- Specially printed materials
- TDD/TTY via 911
- Rumor Control/Citizen Information Center
- Hot Lines
- In addition to these resources, back-up means can also be utilized including a vehicle-mounted public address system, and door-to-door notifications.
- Internet/City Website
- City list-serves (email lists)

Resource Inventories:

Resource inventories list local and regional resources that could be called upon during an emergency situation. These resources can include local contractors and equipment operators, animal shelters, veterinarians, local radio and TV stations, mutual aid dispatch, fuel and generator sources, utility companies, dive teams, search and rescue teams, hazardous materials teams, medical supplies, and helicopter transport. Maintaining an up-to-date and fully populated resource inventory is a challenge for many communities.

Support for Special Populations:

Municipalities have the responsibility to assist persons needing assistance to relocate as well as maintain records of handicapped, special needs and infirm people.

Sheltering Support and Resources:

In-town sheltering space is often limited, and residents may be sent out of town for shelter. Shelters can be American Red Cross approved, providing a place to sleep, eat, get disaster-related first aid, and help reconnecting with family members. Informal shelters (such as warming shelters) may not have the facilities available to be considered an American Red Cross approved shelter space, but can still provide residents with needed assistance. LEOPs identify the location of potential shelters in each community. Shelters, food, and water must be monitored for health and safety concerns, often by the municipal Health Officer. Shelter plans and community sheltering plans are mentioned in many EOPs; however, not all communities have developed these documents. Education and outreach to residents regarding the location and operation of emergency shelters isn't frequently mentioned in LEOPs. Access to food, water, beds, and other shelter supplies are typically of concern to communities.

American Red Cross:

Most EOPs include the American Red Cross as a critical resource for emergency sheltering situations. The American Red Cross can provide the following services during a disaster: a place to sleep, food and water, health services (for disaster-related conditions), emotional

support and mental health services, spiritual care, help reconnecting with loved ones, and information about disaster-related resources in the community.

Volunteer Resources:

Many towns cite the need for more volunteers to serve in emergency management positions, such as volunteer fire departments and as Emergency Management Directors. One issue cited is that in many of the smaller "bedroom" communities, most people work outside of town and are unable to respond to daytime emergencies. Towns also cite concerns regarding the capacity of the town to credential volunteers during an emergency.

Food and Water Safety:

It is often critical to monitor the safety of food and water resources after a disaster, and provide direction to the public as needed. Flood waters can contaminate water and agricultural resources, and prolonged power outages can spoil on-hand food supplies. Communication with the public is critical to help make them aware of food and water safety issues during and after a disaster.

Safe Use of Equipment During Emergencies:

While not typically included in EOPs, staff notes that the proper use of emergency-related equipment such as generators, chainsaws, etc. during emergencies is a frequent topic of discussion during EOP update meetings. More public education on the safe use of equipment commonly used during emergencies could be beneficial in preventing injuries.

14 APPENDIX F: SUMMARY REPORT AND INTERVENTION STRATEGY LIST

Building Resilience Against Climate Effects (BRACE)
Summary Report and Intervention Strategy List

1/20/19

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The BRACE Project is funded by a grant from the Centers for Disease Control and Prevention (CDC) through the National Center for Environmental Health in Atlanta, Georgia. The authors claim responsibility for the contents of this report which does not necessarily represent the official views of the CDC.

Building Resilience Against Climate Effects (BRACE)
Summary Report and Intervention Strategies

This report summarizes the findings from the Building Resilience Against Climate Effects (BRACE) stakeholder and planning sessions. It also reviews the scholarly research on the experiences and health issues of vulnerable populations affected by extreme precipitation, flooding, and storm damage. The focus was on evidence-based intervention strategies with people over 65. This report serves to inform the Leadership Council for a Healthy Monadnock and its partner organizations about public health interventions that could be implemented in the Monadnock Region to: reduce health risks associated with severe precipitation events; and increase storm-preparedness awareness and resiliency of the over-65 population. The three sections that follow include: a summary of planning and stakeholder sessions; evidence-based interventions from the published literature; and an intervention strategy list.

Planning and Stakeholder Sessions

Antioch University New England (Antioch) and Southwest Region Planning Commission (SWRPC) prepared and facilitated a variety of planning and stakeholder sessions. Feedback from these sessions is incorporated into this report for the purpose of assisting the Leadership Council for a Healthy Monadnock Executive Committee in prioritizing and selecting an intervention to implement. Each stakeholder meeting included a brief introduction to the BRACE project and ample time for each group to participate in open dialogue, ask questions, and provide their ideas and feedback. Examples of questions that were asked at planning sessions and some stakeholder sessions included:

- What were your individual and organizational experiences when protecting the health of vulnerable populations before, during, and after extreme precipitation events?
- What needs have you identified, either for a vulnerable population or a health-based organization, as a result of these experiences?
- What interventions were used? How were they successful? How could they be improved?

- Which locations or populations would you like to see included in the input-gathering sessions that inform our Plan of Action and why?

Examples of questions that were asked at stakeholder sessions with vulnerable populations included prompts around:

- Notification: How are you notified about extreme precipitation events and severe weather (such as flooding)? Are these notifications timely and helpful? Are you signed up to receive early warning notices by phone or email? What is the best way to notify you of extreme precipitation events?
- Health Issues: What health issues have you experienced or witnessed, before, during, or after an extreme precipitation or severe weather event? What concerns do you have for your health before, during, and afterwards?
- Assistance: What kind of help was needed, by you or someone you assisted? Did you or others get the help you needed? Do you or others need help to evacuate? If so, what kind? Do you have someone who can help?
- Preparedness: What kinds of emergency preparedness measures were in place? Were they effective? How could they have been improved? What do you need to be independent during a severe precipitation event? Do you have an emergency preparedness kit? If yes, what's in it? If no, why not? Would you use one if it was provided?
- Future Services: What programs or tools would you like to have offered to reduce health issues caused by extreme precipitation events and severe weather?

The following list summarizes the outcomes of each planning and stakeholder session:

Planning Sessions with the Leadership Council for a Healthy Monadnock Executive Committee (LCHM EC)

<u>Planning Session #1 in Keene (9/4/18)</u>

- Southwest Region Planning Commission (SWRPC) staff oriented the LCHM EC to the project goals, timeline, and the Centers for Disease Control (CDC) BRACE framework.

Planning Session #2 in Peterborough (10/2/18)

- SWRPC and Antioch University New England (Antioch) conducted an initial planning session for input on the region's experiences with extreme precipitation, flooding, storm damage, and related health effects or injuries.
- Group discussed the potential for hosting or attending meetings throughout the region to gain additional project input.

Planning Session #3 in Keene (11/6/18)

- Introduced initial ranking exercise of potential public health intervention options.

Stakeholder Sessions with Vulnerable Populations

Monadnock at Home (MAH) & Meals on Wheels in Peterborough (11/15/18)

- Specific challenges and health hazards included:
    - Lack of means by members for receiving emergency messages beyond TV (and radio for members without TV);
    - Lack of services by Meals on Wheels on holidays or weekends;
    - Lack of generators for heat and oxygen or other medical needs;
    - Lack of information by either organization on member needs relating to water, including well water, flood potential, ticks and mosquitoes, mold, etc.;
    - Lack of knowledge of who is vulnerable and getting information to them
- Strategy suggestions included:
    - Provide members with seasonal or safety checklists
    - Provide workshops on emergency preparedness (MOW workshops on fire safety and medication safety were well-attended)
    - Submit survey to membership regarding water-related health issues to follow with information and training

Cheshire Village at Home (CVAH) in Keene (11/29/18)

- Specific challenges and health hazards included:

    - Understanding, by individuals and CVAH, of local contacts to use during a flood, power outage, or crisis;
    - Loss of power, particularly in winter, and medications requiring refrigeration, including insulin;
    - Lack of knowledge by the electric utility, of customers with refrigeration or power needs for medications and medical devices;
    - Loss of heat in winter (with no back-up heat source);
    - Lack of adequate supplies of food, water, and medications during prolonged severe precipitation events;
    - Lack of means of notification of extreme precipitation or severe weather events beyond television and newspaper (many members have no computer access);
    - Respiratory issues for individuals requiring oxygen or continuous positive airway pressure (CPAP) machines during power failures;
    - Respiratory issues after an event where basement or living space was contaminated by mold;
    - Identification of and assistance for individuals with special needs during an emergency, including those with cognitive issues (including dementia), vision impairment, and physical issues resulting in mobility needs;
    - Need for transportation to evacuate during a weather-related emergency;
    - Lack of back-up power preventing CVAH from serving as an evacuation shelter at the Keene Senior Center.
- Strategy suggestions included:
    - Creating a resource list of "where to go" and "who to contact" before, during, and after weather-related (and general) emergencies in the area;
    - Establishing a bulletin board at a central location in each community for publicizing emergency information in a non-electronic form (could also be used as a message board for neighbor check-ins after emergencies);
    - Creating individualized preparedness plans that address responses to specific emergency scenarios;
    - Utilizing Cheshire Village at Home volunteer drivers as a resource for evacuations;

- Leveraging the CVAH phone list, a preferred method of contacting members, as a means of notifying members of severe weather'
- Featuring emergency preparedness trainings as part of monthly social and informational gatherings;
- Creating an "opt-in" process for the organization to collect information on specific health needs, and to share that information with emergency personnel or other agencies as specified in the agreement.

Hinsdale Friendly Meals at Millstream Community Center (11/30/18)

- Specific challenges and health hazards included:
  - Lack of ability to evacuate when main roads flooded, or bridges washed out, or houses on hills became islands due to heavy rains;
  - Lack of knowledge of locations of emergency centers;
  - Lack of preparation for emergencies—most people had only flashlight, contact list, and food and medications on hand;
  - Lack of maintenance of emergency preparedness tools--one person with generator hadn't used it in years and didn't even know if it still worked;
  - Lack of means of being informed about emergencies—some people have a radio and cable TV but report that cable TV has no local weather;
  - Siren warnings in Winchester can't be heard from all locations and buildings in town;
  - Lack of knowledge by local agencies (and MOW) of who the people are that need help;
  - Power outages in Winchester tend to be several days or weeks in duration leading to spoiled food and medications, lack of heat, lack of transportation to pharmacy, and lack of non-electronic communication.
- Strategy suggestions included:
  - Creating and distributing a calendar with emergency information;

- Providing transportation to Keene before, during, and after emergencies.

Keene Friendly Meals (12/4/18)

- Specific challenges and health hazards included:
  - Lack of generators for power during outages
  - Lack of knowledge of who can help with flood damage and mold remediation
  - Lack of good drainage in Keene—one restaurant parking lot flooded with 10" of water while customer ate lunch;
  - Lack of heat when power was out for many days in Westmoreland made one resident worry about insulin storage and hypothermia;
  - Lack of means for evacuation when main road in Westmoreland flooded and house on higher land became an island;
  - Lack of knowledge of where shelters are located and how to get to them (requiring transportation for some and pet inclusion for others);
  - Lack of means of hearing emergency information (if TV not on or wander from phone won't hear messages);
  - Lack of notice, time to assemble pets and medications, and assistance to evacuate
  - Lack of water if well becomes contaminated;
  - Lack of money due to fixed income to maintain emergency preparedness items such as batteries, radio, flashlight, etc.;
  - Lack of knowledge of who to call for help;
  - Eversource doesn't call senior housing to warn about events.
- Strategy suggestions included:
  - Dispersing emergency communication devices to connect with neighbors;
  - Reminding people to "Always keep the gas tank full."

Stakeholder Sessions with Emergency and First Responder Personnel

Monadnock Area Fire Chiefs Association (MAFCA) in Peterborough (10/25/18)

- Specific challenges and health hazards included:
    - Lack of self-reliance of certain groups, including older adults, coupled with the difficulty of contacting them when needed;
    - Carbon monoxide poisoning and fire hazards due to victims of severe weather events utilizing alternative or infrequently-used heat sources;
    - Difficulty or impossibility of notifying people in path of severe precipitation events, including flooding, prior to their occurrence;
    - Chainsaw injuries from trying to cut fallen trees and branches;
    - Lack of information sharing with local emergency personnel about individuals requiring power for oxygen and other life supporting equipment;
    - Identification of health and other emergency needs after an event or problem occurred;
    - Lack of comprehensive wireless phone service, cable television service, and internet in region has led to issues in communicating about severe weather events and other emergencies;
    - Continued need for preventive education such as the National Weather Service's "Turn Around Don't Drown" campaign.
- Strategy suggestions included:
    - Creating an education and outreach program to promote best practices for emergency preparedness and safety in various formats (including Facebook, TV, tax bill inserts, flyers, etc.) suitable for all communities in the Monadnock Region;
    - Engaging with NH Responds assets to assist with training and response, including: Community Emergency Response Teams (CERTs), the Medical Reserve Corps (MRC), and the Disaster Behavioral Health Response Team (DBHRT);
    - Training older adults and other vulnerable groups to be self-sufficient;

- Creating a "census" of older adults, along with their specific health-related needs;
- Proactively visiting/contacting areas routinely damaged by severe weather events and extreme precipitation;
- Utilizing church groups as an avenue to promote best practices, especially with older adults;
- Promoting generator checks to correct problems when they are not needed to avoid problems during a power failure;
- Utilizing "Spotted Dog" software solutions to enhance information provided to emergency responders during an incident.

<u>EMS Service Chiefs of Cheshire County (10/30/18)</u>

- Reviewed project background and goals
- Specific challenges and health hazards included:
  - Inadequate public communication, including cell phones and non-electronic devices throughout the region;
  - Lack of knowledge of people with medical needs;
  - Lack of shelters accepting pets;
  - Lack of refrigeration for medication in mass casualty incident trailer;
  - Lack of personnel during multiple, simultaneous calls;
  - Lack of emergency preparedness items to increase personal resiliency, including alternate heat source, food, disaster kits, sealed storage containers, snow tires, etc.;
  - Lack of back-up power during outages causing food and medications to spoil.
- Strategy suggestions included:
  - Prioritizing means of communication for each town to residents know where to go to find current information;
  - Establishing a mini-shelter for each town or community;
  - Using public buildings in town for heating & cooling places;
  - Constructing a resource list for towns and emergency personnel of local supply vendors;

- "Teach people how to not be victims so we don't have to rescue them."

Stakeholder Sessions with the Keene Energy and Climate Committee (ECC)

Stakeholder Session #1 in Keene (10/3/18)

- Reviewed project background and goals and gained initial input on Committee's perception of vulnerability and potential remedies.

Stakeholder Session #2 in Keene (11/7/18)

- Specific challenges and health hazards included:
  - Weekend flooding of the parking lot of a Keene business in 2005 that didn't "have an emergency plan and probably should.";
  - Vulnerable populations in Keene included senior housing and the homeless living near areas that flood (including the southeast part of Keene near Keene State College);
  - Relocation of Keene condo residents after flooding due to mold in crawl spaces and basements;
  - Extreme heat in buildings during power outages in summer.
- Strategy suggestions included:
  - Utilizing neighborhood associations in Keene;
  - Creating vetted contractor lists for residents (similar to the list by Monadnock at Home) to deal with mold and other health and safety issues;
  - Locating homeless people before severe weather events (as does a member of 100 Nights Resource Center) to offer shelter and attend to health needs;
  - Utilizing fire stations as power islands during emergencies.

Stakeholder Session with the Monadnock Region Healthcare Workforce Group (HWG) and Monadnock Region Regional Coordinating Committee (RCC)

Stakeholder Session in Keene (11/8/18)

- Specific challenges and health hazards included:
  - Lack of physical access to the persons in need in some situations;
  - Lack of knowledge (or protocol) on how to vet emergency volunteers;

    - Lack of space to store three days of food in community settings, especially when staff and family stay during emergencies;
    - Difficulty maintaining lists of special needs populations.
- Suggested strategies included:
    - Using emergency cards in windows to notify authorities if help is needed (currently beta testing in Nelson)
    - Educating the public on emergency notification protocols "so they will not jam the phones and all report the same thing";
    - Educating the public on emergency preparedness in case "emergency services are flooded out";
    - Expanding memorandums of understanding (MOU) beyond immediate service area in case local facilities all impacted by same emergency;
    - Allowing people "who naturally respond, respond—keep charge of them but let them respond."

Summary of Stakeholder Sessions

The 9 stakeholder groups yielded many important and common themes as intervention needs and goals for the Monadnock Region (Table 1). Common themes with more than 50% stakeholder support are shown in the following table. All groups agreed that sources of non-electronic communication were paramount for safety messages before, during, and after events, especially when power outages may be present. However, building adaptive capacity of individuals, neighborhoods, and communities when emergency services may be preoccupied or unable to respond was also important, and most concerns aligned with the Climate Health Adaptation Plan (CHAP) intervention for emergency preparedness (Greater Monadnock Public Health Network, 2017), including empowerment, building resources (human, information, infrastructure), and identifying populations at highest risk. Eight out of the 12 topic areas listed in the table aligned with the CHAP intervention for emergency preparedness, suggesting that emergency preparedness education and resources were a desired need for the Monadnock Region and a viable intervention for the BRACE project.

Table 1.

Topics of Interest and Concern at BRACE Stakeholder Sessions, Fall 2018

TOPIC	CATEGORY	CHAP INTERVENTION	%
Non-electronic notification	Notification	Early Warning Systems	100
Empowerment	Resiliency	Emergency Preparedness	78
Lack of resources	Human Resources	Emergency Preparedness	78
Flooded towns vulnerable	Vulnerability	Emergency Preparedness	67
Shelters	Physical Needs	Emergency Preparedness	67
Resources	Physical Needs	Emergency Preparedness	67
Power for medical devices	Physical Needs	Emergency Preparedness	67
Registry of people with medical needs	Notification	Registry	67
Emergency preparedness education	Physical Needs	Emergency Preparedness	56
Senior housing vulnerable	Vulnerability	Emergency Preparedness	56
Earlier warnings	Notification	Early Warning Systems	56
Door to door checks	Notification	Neighborhood Watch	56

Evidence-Based Interventions

A review of the literature was conducted during the fall of 2018 using Academic Search Complete, BioOne Complete, Ebsco Open Dissertations, Google Scholar, Humanities International Complete, Web of Science, and Wiley Online Library database searches. Literature that did not address flooding, health impacts, and older people (or the elderly) were excluded from this review. Over four hundred journal articles and dissertations were scanned for references to interventions involving older people, health, and flood events. One hundred articles that most closely met the search parameters were reviewed (Figure 1). Case studies varied in their applicability due to their design and applicability. The following is a brief overview of the available literature.

Theory and Educational Publications

There is a plethora of theoretical literature available on emergency preparedness and early warning systems, particularly in the area of flood hazard mitigation strategies at the infrastructure level. There are also instructional brochures on how to prepare for emergencies, from those published by FEMA to some written by seniors for seniors. *Older Adults and*

Disasters: How to Be Prepared and Assist Others (APA, n.d.) emphasizes having phone lists of people to call during or after an event, having an emergency preparedness kit, and knowledge of the local evacuation routes.

Case Studies

Case studies have been conducted after flooding events worldwide. Research has been conducted on health impacts, including death, disease, emergency care (Bell et al., 2018); mental health; and water quality (Rahman et al., 2018); early warning systems, including the use of social media (Stephenson et al., 2017), fire sirens (Taylor, 2013), and phone apps; emergency preparedness training (Duffy and Stewart, 2008), community resiliency (Moreno et al., 2018), and information-seeking behavior change (Teo et al., 2018); flood risk mitigation and infrastructure; and emergency personnel training and health risks. One case study on the 2011 and 2013 Brisbane, Australia floods stressed the importance of information sharing, collaboration, and creating a database to identify people in need of "formal assistance" (Brockie, 2016). The most relevant case studies (Appendix 1) totaled 66 (Figure 1).

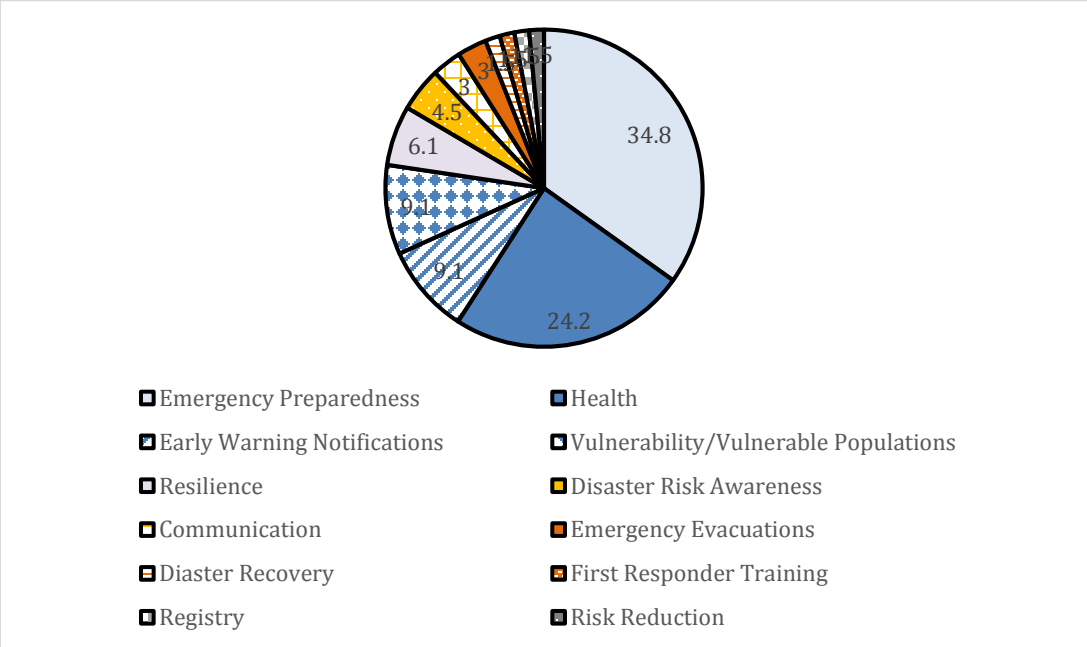

Figure 1. The variety of case study topics in the literature to inform BRACE project goals.

Nearly 35% of the case studies were on the subject of emergency preparedness, followed by health-related issues at 24%. Early warning systems and vulnerable populations each represented 9% of the studies, followed by resilience at 6%. The remaining 15% of the studies were on the subjects of disaster risk awareness and reduction, recovery, emergency evacuations, communication, first responder training, and registries.

Additional Research

Empirical research has been conducted on topics relating to mitigation of health risks of vulnerable populations affected by flooding events. One area with ample research is the effectiveness of early warning systems and communication before and during severe precipitation events (Taaffe et al., 2013). Additional research has investigated the impacts of flooding on infrastructure, and of sea-level rise due to climate change on tidal floods (Kruek, 2015). Bodoque et al., 2018, concluded that emergency preparedness education was effective in preparing residents for disaster by increasing their flood risk perceptions.

Key Findings

The available literature supports a wide array of intervention strategies that could be implemented in the Monadnock Region. A few, however, should be emphasized, as they may be replicated. They include: community flood education (Duffy and Stewart, n.d.) and emergency preparedness education (Bodoque et al., 2018); the importance of local knowledge of disasters and neighbors helping neighbors (Moreno et al., 2018); the need for multiple means of communication and channels as early warning systems before and during emergencies (Morris et al., 2014), and to locate people who may be lost during or after an event (Davenport, 2018); and the importance of maintaining a database of people who need assistance during disasters (Brockie, 2016).

Intervention Strategy List

The following is a brief example of interventions that could be implemented in the Monadnock Region.

1. Emergency Preparedness

   Goal: Reduce health risks before, during and after extreme precipitation events (carbon monoxide poisoning, disease, death, drowning, hypothermia, electrocution, chainsaw injuries, air and water-borne illness from contaminated belongings (Tapsell et al., 2002)

   a. Create and disperse 100 emergency preparedness tool kits to pilot study recipients (contents may include: checklist of items to purchase, replenish or update; list of area resources for assistance; list of phone apps for early warnings; personal list of emergency contact numbers, pre-planned evacuation locations, and medications; coupons for or donations of batteries, flashlight, battery-powered radio. canned goods and opener, bottled water, blanket, basic first aid kit, toiletries, and plastic water-tight storage container for contents)
   b. Conduct emergency preparedness (and tool kit) trainings for social service agencies and individuals over 65 (may include education on rescue operations protocols, how to prepare for severe weather, contacting power company or service agencies if need power for medical devices or assistance with evacuations, routine maintenance of car, generator, power tools used during emergencies)
   c. Create a multi-media campaign to support use of kits and trainings (may include public service announcements for radio & television, posters for public places, or articles for local papers, websites, and newsletter inserts)

RESPONSIBLE PARTY	BRACE agencies with collaboration from EMDs, social service agencies
TARGET POPULATION	100 individuals (target host agencies: Cheshire Village at Home, Keene Senior Center, Monadnock at Home, Meals on Wheels)
EVALUATION	Survey to determine increased risk awareness and personal use
EFFECTIVENESS	Research support for contamination, car drownings; local support for chainsaw injuries
FEASIBILITY	High: first trainings can be completed in allotted time frame
SUSTAINABILITY	High with ongoing implementation and trainings through social service agencies, especially during high-impact seasons
COST	Negligible (printing costs) if remainder of items are donations or purchased via coupons and gift cards
UNINTENDED CONSEQUENCES	Education reaches broader audience, increasing community resilience
COMMENTS	Possible donations or coupons for tool kit items or replacements? Possible digital presentation dispersed to social service agencies to continue to educate staff and population?

2. Emergency Preparedness

Goal: Enhance communication and collaboration between adults and service agencies and emergency personnel by providing an emergency resource list for the Monadnock Region. (List may include transportation, traveling nurses, shelter locations by municipality, contact information for emergency management directors (EMDs) and road agents by municipality, etc.)

a. Create a list of emergency, volunteer, and social service organizations with services provided, region covered, and contact information
b. Publish resource list and distribute through Monadnock at Home, Cheshire Village at Home, Keene Senior Center, Meals on Wheels, town halls and libraries, etc.
c. Publish resource list on website where organizations can submit contact changes

RESPONSIBLE PARTY	regional level
TARGET POPULATION	Anyone over 65 via public and organizational distribution
EVALUATION	Survey recipients and service providers to track calls using provided information and assess usefulness of information
EFFECTIVENESS	Local support for information sharing/publication
FEASIBILITY	High
SUSTAINABILITY	High if list is updated and distributed regularly
COST	
UNINTENDED CONSEQUENCES	List may identify overlapping services or gaps in service coverage in area; may increase individual's independence during emergencies through systemic support
COMMENTS	Could be included in emergency tool kit

3. Emergency Preparedness

Goal: Enhance communication between population needing assistance and organizations providing assistance by using a Release of Information (Memorandum of Understanding) in which an individual gives permission to keep medical/emergency information on file for emergency prioritization purposes (electricity for oxygen, wound vac, or refrigerated medications; physical assistance to evacuate, etc.) (Release form to be updated annually)

RESPONSIBLE PARTY	Individual service agency, power company, etc.
TARGET POPULATION	Anyone over 65
EVALUATION	Survey recipients and service providers to track events using provided information and assess efficiency of program
EFFECTIVENESS	Local support for information sharing/publication
FEASIBILITY	High
SUSTAINABILITY	High if list is updated annually or as information changes
COST	Low
UNINTENDED CONSEQUENCES	May be burdensome to individual who has to contact several agencies to update information on release forms (whether by phone, mail, or website)
COMMENTS	Checklist of agencies with permission to know personal information could be included in emergency tool kit

4. Early Warning Systems

Goal: Increase percentage of people using electronic apps to notify them of extreme precipitation events, hazardous weather including high heat and ozone, and forecasted events that could result in flooding and power outages by providing information brochure on benefits of early warning systems, available apps, and where to go for help installing them on devices (Apps might include American Red Cross, Code Red, FEMA, National Weather Service)

RESPONSIBLE PARTY	BRACE agencies with collaboration from EMDs, social service agencies
TARGET POPULATION	Anyone over 65 with a cell phone or computer, particularly those living alone or in rural areas; brochure could be distributed through Cheshire Village at Home, Keene Senior Center, Meals on Wheels, Monadnock at Home
EVALUATION	Track new members via app providers; survey recipients to assess efficiency of app and weather categories enabled
EFFECTIVENESS	Local support for information sharing/publication; research support for early warning apps
FEASIBILITY	High
SUSTAINABILITY	High
COST	Low
UNINTENDED CONSEQUENCES	Apps could be installed by other friends and family members, skewing data but increasing reach of early warning systems
COMMENTS	List of apps could be added to emergency tool kit

5. Neighborhood Watch

Goal: Empower neighborhood resiliency during extreme precipitation events, identify neighbors in need, and assist emergency personnel in accounting for neighbors during emergencies by creating and maintaining localized information hubs

a. Neighborhood/town volunteer to maintain bulletin board(s) in central location(s) for emergency information from EMD or town road agent about power outages, road closures, shelter locations and hours, drinking water bans, etc.
b. Neighborhood/town volunteer to maintain Facebook page for emergency information from EMD or town road agent about power outages, road closures, shelter locations and hours, drinking water bans, or for residents to post they are safe or in need of assistance if they cannot connect with officials by other means
c. Identify and publicize volunteer for area of town equipped with transportation, generator, and safe access route to serve as host shelter if municipal shelter is not available or cannot be reached

RESPONSIBLE PARTY	Town EMD with road agent
TARGET POPULATION	Anyone over 65 (pilot study could compare rural town with urban area)
EVALUATION	Survey of selected neighborhoods, volunteer neighborhood captain, EMD and road agent to assess need and usefulness
EFFECTIVENESS	Some local and research support--already in place in some areas at unorganized and unofficial levels
FEASIBILITY	High
SUSTAINABILITY	High if volunteers remain committed
COST	Low
UNINTENDED CONSEQUENCES	May be burdensome to volunteer if neighbors rely on captain rather than prepare for emergencies themselves; may increase social capital by creating a stronger neighborhood community
COMMENTS	Could potentially be combined with maintenance of registry for vulnerable persons with medical needs

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Appendix

Appendix 1. Literature Review

Intervention	Title, Author, Year	Methods	Results & Implications	Use for BRACE
RISK REDUCTION	A comparative analysis of the loss of life during two recent floods in France: the sea surge caused by the storm Xynthia and the flash flood in Var (Vinet et al., 2011)	CASE STUDY	71% of nighttime sea surge deaths were people over 60; flash flood deaths were varied, many of them from risk-taking behaviors outside.	Low--data to support flood risk behavior
HEALTH	A cross-sectional survey on the health status and the health-related quality of life of the elderly after flood disaster in Bazhong city, Sichuan, China (Wul et al., 2015)	CASE STUDY (household survey)	Bazhong higher rate of medical needs but lower rate of chronic illness than rural elderly (aged >60) sampled after 2011 flood	Low
EMERGENCY PREPAREDNESS (education)	A new approach to community flood education (Dufty, 2008)	CASE STUDY	The Maitland Australia flood education plan included input from residents, businesses, and landowners, increasing their concerns and appropriate behavior responses to flooding above levels prior to the plan's development.	Medium
EMERGENCY PREPAREDNESS	A PMT-TTM model of protective motivation for flood danger in the Netherlands (Bočkarjova et al., 2009)	CASE STUDY	The majority of the population of the Netherlands was not at the action stage of adopting flood protection measures. It was suggested that improved general awareness would increase motivation.	HIGH--applies to BRACE objectives

EMERGENCY PREPAREDNESS (infrastructure)	Adaptive Strategies and Transformation for Community Recovery A Case Study of Villages in Hinthada, Ayeyarwady Region, Myanmar (Otsuyama et al., 2018)	CASE STUDY (household survey)	Unprotected villages adapted elevated houses against floods and planted water-resistant crops for income; protected villages relied on dyke maintenance and mitigation strategies for protecting their non-elevated houses.	Low
HEALTH	After the flood: the health and social consequences of the 2005 Carlisle flood event (Convery and Bailey, 2008)	CASE STUDY	Emphasis the first 2 days after the flood was on finding food and shelter while flood waters receded. Some residents were displaced over 16 months while waiting for their homes to be rebuilt. Health impacts included depression, mental breakdowns, and death.	Low
HEALTH	All-Cause Hospital Admissions Among Older Adults After a Natural Disaster (Bell et al., 2018)	CASE STUDY	Hospital admissions by older adults increased 4% after a 2011 tornado in the United States	Low
COMMUNICATION	An approach for improving flood risk communication using realistic interactive visualisation (Kuser Olsen et al., 2018)	COMPARATIVE CASE STUDY	Stakeholders were more likely to adopt risk-reduction behaviors after viewing realistic (photographic) interactive maps rather than the HAZUS line-drawing maps used by FEMA.	HIGH--informs BRACE objectives

EMERGENCY PREPAREDNESS (education)	Applying Instructional Design Strategies and Behavior Theory to Household Disaster Preparedness Training (Thomas et al., 2018)	CASE STUDY (research)	Ready CDC was successful in promoting behavior change towards adoption of emergency plans and kits and serves as a model for future interventions.	HIGH--applicable to BRACE objectives
HEALTH	Association between floods and typhoid fever in Yongzhou, China (Liu et al., 2018)	CASE STUDY	Floods were associated with an increase in typhoid fever cases, with children under 5, and adults 15-64, including farmers, in the most vulnerable groups.	Low
EMERGENCY PREPAREDNESS	Children in the 2015 South Indian floods: community members' views (Krishna et al., 2018)	CASE STUDY	Common themes included helplessness; unexpectedness of the flood; and determination to be prepared for the next flood.	Low
HEALTH	Climate hazards--lessons from recent events in the United States (Riebsame, 1985)	CASE STUDY	Heat, cold, and flood hazard events resulted in more effects on human and environmental health than structural damage, affecting mostly the poorest, oldest, and youngest members of the community; effects were prolonged and cumulative.	HIGH--supports BRACE project

EARLY WARNING NOTIFICATIONS	Communication's Role and Technology Preferences during Hurricane Evacuations (Taaffe et al., 2013)	CASE STUDY (survey)	Respondents preferred emergency evacuation information via radio when driving and TV when at home. Daytime evacuations were preferred suggesting notices should be made early enough to allow for daytime travel.	Medium--supports BRACE early warning objective
RESILIENCE	Community resilience in response to the 2010 tsunami in Chile: The survival of a small-scale fishing community (Moreno et al., 2018)	CASE STUDY (survey)	Local knowledge of past disasters and neighbors prepared with emergency supplies to help each other reinforced role of community resilience during a disaster.	HIGH--BRACE goal
EMERGENCY PREPAREDNESS	Community responses to flood risk management – An empirical Investigation of the Marine Protected Areas (MPAs) in Malaysia (Mehedi Masud et al., 2018)	CASE STUDY (household survey)	Perceived flood risk and vulnerability and benefits of participation in prevention activities was associated with intent to engage in risk-reducing behaviors.	HIGH--informs BRACE objectives
EMERGENCY PREPAREDNESS	Community-based disaster management during the1997 Red River Flood in Canada (Buckland and Rahman, 1999)	CASE STUDY (mixed methods)	The level and pattern of community development affected the community's capacity to respond to flooding; the native community was more marginalized.	Low

HEALTH	Community-based public health interventions in North Korea: one non-governmental organization's experience with tuberculosis and hepatitis B (Goe and Linton, 2004)	CASE STUDY	Collaborative efforts were based on years of building trust and governmental relationships and programs that were sensitive and inclusive of local professionals.	Low
HEALTH	Community-level social capital and cognitive decline after a natural disaster: A natural experiment from the 2011 Great East Japan Earthquake and Tsunami (Hikichi et al., 2018)	CASE STUDY	Residents who socialized with the community before and after the disaster exhibited less cognitive decline 2.5 years later, suggesting that socialization and cognitive resilience lessened the effects of housing damage on older adults.	Low
EMERGENCY PREPAREDNESS (infrastructure)	Coping with extremes – experiences from event management during the recent Elbe flood disaster in 2013 (Jüpner, 2016)	CASE STUDY	Post-flood assessments concluded that preparation and risk assessment were necessary to mitigate the negative consequences of floods.	Low
DISASTER RISK AWARENESS	Disaster awareness and information seeking behaviour among residents from low socio-economic backgrounds (Teo et al., 2018)	CASE STUDY (survey)	Disaster awareness of low socioeconomic groups in Logan City, Australia was influenced by proficiency in the English language and familiarity with local environments; in high socioeconomic groups, females had a higher disaster awareness than males; however, people still	HIGH--study could be replicated to inform early warning systems

			depended on TV for disaster news.	
EARLY WARNING NOTIFICATIONS	Early Warning Disease Surveillance After a Flood Emergency — Pakistan, 2010 (Sabatinelli et al., 2012)	CASE STUDY	A disease early warning system was useful in detecting disease outbreaks of epidemic-prone diseases resulted from the flood; however, lack of standardization in reporting challenged the use of the data at a regional scale.	Low
1ST RESPONDER TRAINING	Educating First Responders to Provide Emergency Services to Individuals with Disabilities (Wolf-Fordham et al., 2015)	CASE STUDY	A significant gain in learned knowledge and applied skills was made after taking the on-line course.	Medium--may inform future BRACE objectives
HEALTH	Effect of 2014 massive flood on well water qualities: A case study on Kelantan River basin, Malaysia (Rahman et al., 2018)	RESEARCH & CASE STUDY	95% of wells were contaminated after the December 2014 flood; contaminants existing prior to flooding may exacerbate health risks after flooding occurs.	Low

VULNERABILITY	Emergency Department Visits for Homelessness or Inadequate Housing in New York City before and after Hurricane Sandy. (Doran et al, 2016)	CASE STUDY	A statistically significant increase was documented in emergency department visits by elderly and people with Medicare after Hurricane Sandy who were assessed as homeless or with inadequate housing.	Low
EMERGENCY EVACUATIONS	Emergency evacuation of the Dresden Heart Centre in the flood disaster in Germany 2002: perceptions of patients and psychosocial burdens (Nitschke et al., 2006)	CASE STUDY	Cardiac patients were successfully evacuated from a hospital during a flood without an increase in PTSD; patients expressed feelings of safety during the process, and concerns about a lack of information about transportation modes used during the evacuation.	Low
EMERGENCY EVACUATIONS	Emergent disaster response during the June 2007 floods in Kingston upon Hull, UK	CASE STUDY	Community wardens and neighbors assisted vulnerable populations immediately after the flood when people felt the need to act when the need was perceived as urgent.	Medium--informs BRACE social capital objectives
DISASTER RISK AWARENESS	Enhancing flash flood risk perception and awareness of mitigation actions through risk communication (Bodoque et al., 2018)	CASE STUDY (pre & post survey)	Flood risk perception increased after an educational component in Spain.	Medium--supports BRACE project

HEALTH	Environmental health aspects of drinking water-borne outbreak due to karst flooding: case study (Dura et al., 2010)	CASE STUDY	Flooding contaminated the underground water source for a Hungarian city requiring public health interventions for water-borne illness risk reduction and safe drinking water.	Low
EMERGENCY PREPAREDNESS	Evacuation preparedness and the challenges of emergency evacuation in Indigenous communities in Canada: The case of Sandy Lake First Nation, Northern Ontario (Workeye Asfaw et al., 2018)	CASE STUDY (focus groups)	A lack of community preparedness to respond to wildfires, including delayed information and lack of clarity of procedures to follow to declare an emergency increased the community's vulnerability to wildfire emergencies.	Low--informs BRACE research design
EMERGENCY PREPAREDNESS (infrastructure)	Evaluating rain gardens as a method to reduce the impact of sewer overflows in sources of drinking water. (Autixier et al., 2014).	CASE STUDY (research)	Rain gardens were less effective for large events, which were of greater importance for drinking water sources.	Low
EARLY WARNING NOTIFICATIONS	Evaluating Uses and Adoption of Media Innovations in Disaster Warnings: A Case Study of Sindh-Pakistan (Shaikh, 2016)	CASE STUDY	Policies for disaster warnings were only for frequently-occurring risks, such as floods, and other risks, such as heat, were addressed when they occurred.	Low
VULNERABLE POPULATIONS	Experiences and perceptions of natural hazards among international migrants living in Valparaiso, Chile (Bernales et al., 2018)	CASE STUDY	Migrants had limited knowledge about natural disasters and risk reduction behaviors; information should target migrant social networks to	Low

			increase their adaptive capacity.	
DISASTER RISK AWARENESS	Flash Flood Awareness in Southwest Virginia (Knocke and Kolivras, 2007)	CASE STUDY (survey)	Experts underestimated the level of public perception of flood risk while the public overestimated the level of risk perception by experts. Previous experience with floods did not necessarily increase awareness. Men were more aware of severe hazards than women, and older people were more aware than youth. The public was more concerned with other disasters even though flash floods were the deadliest.	HIGH--supports BRACE project
EMERGENCY PREPAREDNESS	Hurricane preparedness among elderly residents in South Florida (Kleier et al., 2018)	CASE STUDY	Findings supported model of decision process. Barriers to preparation were cost of efforts and need for cooperation. Many were prepared to shelter in place but unprepared to evacuate if needed.	Medium--informs BRACE objectives

HEALTH	Impacts of flood on health: epidemiologic evidence from Hanoi, Vietnam (Bich et al., 2011)	CASE STUDY (affected vs. non-affected households)	Deaths, injuries, diseases, and psychological problems 1 month after the event were higher in severely-affected communities.	Low
HEALTH	Indirect consequences of extreme weather and climate events and their associations with physical health in coastal Bangladesh: a cross-sectional study (Beier et al., 2015)	CASE STUDY	Women and the elderly had a higher chance of contracting diseases from drinking water from open sources.	Low
EMERGENCY PREPAREDNESS	'It'll never happen to me': understanding public awareness of local flood risk (Burningham et al., 2007)	CASE STUDY	Flood risk awareness, which often underestimates the impacts of rare or extreme flood events, is affected by an individual's class, flood experience, and duration of residence, suggesting the need to involve residents in the local awareness-raising process.	Medium
EMERGENCY PREPAREDNESS (education)	Knowledge Sharing for Disaster Risk Reduction: Insights from a Glacier Lake Workshop in the Ladakh Region, Indian Himalayas (Ikeda et al., 2015)	CASE STUDY	Survey 3 months after emergency preparedness workshop confirmed an improvement in knowledge by residents of natural disasters and highlighted the importance of incorporating new scientific knowledge into local knowledge and beliefs.	HIGH--similar to BRACE project

HEALTH	Long-term psychological outcomes of flood survivors of hard-hit areas of the 1998 Dongting Lake flood in China: Prevalence and risk factors (Dail et al., 2017)	CASE STUDY (interviews)	Factors influencing PTSD and anxiety among survivors 17 years after the flood were gender (female), prior experience with floods, low levels of social support, and emotional instability.	Medium--could be duplicated in region to inform BRACE project
HEALTH	Loss of Life Caused by the Flooding of New Orleans After Hurricane Katrina: A Preliminary Analysis of the Relationship Between Flood Characteristics and Mortality (Jonkman et al., 2008)	CASE STUDY	Findings supported previous research that higher death rates were incurred in areas where breaches were severe and where flood waters were deepest.	Low
EMERGENCY PREPAREDNESS	Mitigating flood exposure : Reducing disaster risk and trauma signature (Shultz et al., 2013)	CASE STUDY	Fargo exceeded Minot in reducing disaster risks through mitigation strategies, minimizing human trauma.	Medium--supports BRACE emergency preparedness objectives
HEALTH	Narratives of recovery after floods: Mental health, institutions, and intervention (Butler, 2018)	CASE STUDY	Mental health after flood events was influenced by perceived institutional support.	Medium--supports BRACE sustainability objectives
EMERGENCY PREPAREDNESS	People at Risk of Flooding: Why Some Residents Take Precautionary Action While Others Do Not (Grothmann & Reusswig, 2006)	QUALITATIVE PHONE SURVEY	Flood-prone residents of Cologne, Germany were more motivated to engage in risk reduction behaviors when education included the risk of flooding and its consequences paired with the effectiveness and cost of private preparedness measures.	Medium--supports BRACE strategies

EMERGENCY PREPAREDNESS	Planning for Countering Climate Change: Lessons from the Recent Plan of New York City — PlaNYC 2030 (Jabareen, 2013)	CASE STUDY	PlaNYC failed to address the vulnerability and needs of communities affected by Hurricane Sandy due to lack of public participation in its design and implementation.	Low
EMERGENCY PREPAREDNESS	Plans and Prospects for Coastal Flooding in Four Communities Affected by Sandy (Wong-Parodi al., 2017)	CASE STUDY	People underestimated the risks associated with future coastal flooding but were willing to undertake risk-reducing measures if they believed the measures were effective.	HIGH--supports BRACE project
EMERGENCY PREPAREDNESS	Primary healthcare system capacities for responding to storm and flood-related health problems: a case study from a rural district in central Vietnam (Van Minh et al., 2014)	CASE STUDY	Emergency medical services were not always available during flood seasons. Emergency plans focused on disaster recovery rather than prevention.	Low--serves as support for BRACE emergency preparedness objectives
HEALTH	Public Health Consequences of a Flood Disaster — Iowa, 1993 (Atchiso et al., 1993)	CASE STUDY (phone survey)	The flood caused the interruption of services by primary care physicians, vaccination clinics, supplemental food programs, the Des Moines public water system, public sewer systems, and increased issues with vectors, mosquitoes, and rats. Electrocution caused 1 death and 5 cases of carbon monoxide	Medium--informs BRACE objectives

			poisioning were reported.	
RESILIENCE	Public involvement in the Red River Basin management decisions and preparedness for the next flood (Haque et al., 2002)	CASE STUDY	Hearings by the International Joint Commission were more sensitive to resident needs than meetings by the Red River Basin Task Force, by incorporating public suggestions and concerns to make the proposed projects and programs more socio-economically feasible.	Medium--informs BRACE project sustainability
VULNERABILITY	Reinforcing vulnerability? Disaster relief, recovery, and response to the 2001 flood in Rawalpindi, Pakistan (Mustafa, 2011)	CASE STUDY	Analysis of relief and recovery after 2001 flood suggested a participatory approach to the recovery needs assessment with attention to gender variable affecting vulnerability.	Low
EMERGENCY PREPAREDNESS (education)	Sustainable flood risk management strategies to reduce rural communities' vulnerability to flooding in Mozambique (Lumbroso et al., 2008)	CASE STUDY	The impact of flooding was reduced through workshops on flood mitigation and educational tools in the 3 pilot communities.	HIGH--supports BRACE project

EMERGENCY PREPAREDNESS	Taking stock of community-based flood risk management in Malawi: different stakeholders, different perspectives (Trogrlic et al., 2017)	CASE STUDY (focus groups)	Common challenges among stakeholder groups were a lack of in-country resources, financing, participation, localized project ownership and sustainability.	Medium--similar to BRACE
EARLY WARNING NOTIFICATIONS	The Benefits of Flood Warnings: Real But Elusive, and Politically Significant (Penning-Rowsell et al., 2007)	CASE STUDY	Dissemination of hazard warnings and public response were weak links in the communication chain. Overall, the public was dissatisfied with the warning system in place.	Low
DISASTER RECOVERY	The flood recovery gap: a real-time study of local recovery following the floods of June 2007 in Hull, North East England (Medd et al., 2014)	LONGITUDINAL CASE STUDY	Recovery was an ongoing process during which residents had to create a new version of normal for their homes, families, and communities.	Medium--informs BRACE project
COMMUNICATION	The role of Facebook and Twitter as organisational communication platforms in relation to flood events in Northern Ireland (Stephenson et al., 2017)	CASE STUDY	Organizations distributed more information in reaction to flood; Twitter broadcasted more information while Facebook encouraged more behavior.	Low
EMERGENCY PREPAREDNESS	The role of social capital in flood preparedness in Kilosa District, Tanzania, (Hegga, 2013)	CASE STUDY (household survey)	Flood preparedness was more successful when built on frequent interactions and trusting relationships. Emergency response was more successful when built on existing networks.	Medium--informs BRACE project objectives

EARLY WARNING NOTIFICATIONS	The Spatial Distribution of Siren Acoustics in Columbiana County, Ohio (Taylor, 2013)	CASE STUDY	Not all sirens were activated for every event. Siren codes were not standard across the country.	Medium--informs BRACE project
VULNERABILITY	The vulnerability of the elderly to hurricane hazards in Sarasota, Florida (Wang and Yarnal, 2012)	CASE STUDY	Various levels of vulnerability exist in elderly populations: residents of barrier islands more physically vulnerable but inland residents more socially and economically vulnerable due to less wealth, resources, and adpative capacity.	Medium--informs BRACE project
VULNERABILITY	The Vulnerability of Low-income Communities to Flood Hazards, Missionvale, South Africa (Siyongwana et al., 2015)	CASE STUDY	The community was vulnerable to flooding due to weak social resources, limited infrastructure, poorly-built houses, and lack of institutional support. Recommendations included strengthening community participation, acknowledging indigenous flood knowledge, and providing early warning systems.	Medium--supports BRACE objectives
RESILIENCE	Understanding Older Adults' Resilience During the Brisbane Floods: Social Capital, Life Experience, and Optimism (Brockie and Miller, 2017)	CASE STUDY	Survivors of the 2011 and 2013 Brisbane floods identified social capital and previous disaster experience as building resiliency.	HIGH--supports BRACE project

EMERGENCY PREPAREDNESS	Urban disaster preparedness of Hong Kong residents: A territory-wide survey (Pui Kin Lam et al., 2017)	CASE STUDY (survey)	Information before and during disasters was received through TV, despite youth preferring social media and the internet and older residents preferring radio and TV. Less than 40% of respondents had an emergency kit.	HIGH--informs BRACE objectives
RESILIENCE	Urban–Rural Differences in Disaster Resilience (Cutter et al., 2016)	COMPARATIVE STUDY	Urban disaster resilience was driven by economic capital while rural disaster resilience was driven by community capital; variability in rural resilience suggested the use of strategies targeted at the smaller community scale.	Low--may inform BRACE strategies
EARLY WARNING NOTIFICATIONS	Use of social media during public emergencies by people with disabilities (Morris et al., 2014)	CASE STUDY (survey)	Emergency communications should include multiple sources to reach the community: deaf people used social media to receive, verify, & share emergency info but younger groups use social media more than older populations.	Medium--informs BRACE project
VULNERABLE POPULATIONS	Vulnerability of families and households to natural hazards: A case study of storm surge flooding in Sarasota County, Florida (Hung et al., 2016)	CASE STUDY	Elderly homeowners living alone on exposed barrier islands were the most vulnerable to natural hazards.	Medium--supports BRACE project target population

HEALTH	Vulnerability to flooding: health and social dimensions (Tapsell et al., 2002)	RESEARCH (focus groups)	Issues raised by focus groups 3-4 months after the June 2000 flood in England were inadequate support for the elderly and disabled after the event, and the lateness of advice on dealing with contaminated possessions.	Medium--informs BRACE project & identifies flood-related health issues
EMERGENCY PREPAREDNESS	What Motivates Individuals to Protect Themselves from Risks: The Case of Wildland Fires. (Martin et al., 2007)	CASE STUDY	Perceived degree of vulnerability motivated low-knowledge homeowners at the precontemplative stage to engage in risk-reduction behaviors, while high-knowledge homeowners were motivated by the perception of risk severity.	Medium--informs BRACE objectives
REGISTRY	"What doesn't kill us" – the experience of older adults evacuated during the 2011 and 2013 Brisbane floods. (Brockie, 2016)	CASE STUDY (dissertation)	This research emphasizes the need for a database of residents most likely to be vulnerable during natural disasters and collaboration between health care providers, faith-based organizations, and service agencies to assist with evacuation planning and increasing resilience of older adults.	HIGH--excellent resources & suggestions for BRACE project