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Enhancing the Resilience of Vulnerable Groups Through Participatory Climate Change Adaptation Planning: A Case Study with the Elderly Community of Bridgeport, Connecticut

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Enhancing the Resilience of Vulnerable Groups Through Participatory Climate Change Adaptation Planning: A Case Study with the Elderly Community of Bridgeport, Connecticut

by

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Abstract

Recent reports highlight the vulnerability of the elderly to climate change. Unfortunately, a lack of research incorporating the perspectives of the elderly on this topic could cause their needs to go unrecognized and unaddressed. To promote adaptation planning that is responsive to the concerns of the elderly, this dissertation presents the results of a participatory research and adaptation planning process conducted in partnership with the elderly community of Bridgeport, Connecticut. The process combined a five-step climate change adaptation planning model with a community-based action research approach that placed the elderly participants as key drivers in the research and planning processes. For this research, the elderly participants began by exploring their vulnerability to current and predicted climate stressors including extreme heat, flooding, storms, and air pollution. They then developed adaptation goals and strategies. Finally, a summative evaluation assessed the planning process itself. Among the key findings, this research identified personal attributes, including health, economic, and social characteristics, that interact with a range of contextual factors to influence the elderly population's vulnerability. As a result, predicted climate changes could have serious consequences for Bridgeport's elderly. Participants recommended adaptation goals and strategies to enhance their resilience with a focus on encouraging preparedness and providing community services including warning mechanisms, resources to secure safe shelter, transportation resources, as well as resources to aid in coping and recovery. A prioritization exercise showed that participants believed all the suggestions were likely to be effective and feasible to implement. Furthermore, the summative evaluation revealed that the participatory planning process enhanced the elderly's resilience by raising awareness and understanding, increasing communication, and strengthening elders' ability to self-advocate. Key themes that contributed to the process's effectiveness

included the value of collaborating with local organizations, fostering an accessible and inclusive process, connecting subject matter with the day-to-day concerns of participants, and using an iterative process to build the capacity of participants. While limited to a single case study, this research offers potentially transferable insights into the broader elderly community's vulnerability to climate change and presents a model for engaging vulnerable groups in adaptation planning.

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Chapter 1. Introduction

Climate change is predicted to significantly impact the northeastern United States. Recent studies highlight rising sea level, increased high precipitation events, increased frequency of high temperature days, and increased air pollution as among the potential impacts (Horton et al., 2014; IPCC, 2014). The elderly have been recognized as having a heightened vulnerability to these impacts (IPCC, 2014; Luber et al., 2014).

While we have some understanding of the causes of the elderly's vulnerability to natural disasters and climate related stressors, there is little research into their vulnerability to climatic stressors in the context of climate change. This limited understanding may be exacerbated by the elderly's potential lack of participation in climate change adaptation planning processes. As a result, their needs and concerns might go unrecognized. Without these understandings, it is difficult to take steps to effectively reduce their vulnerability to climate change. To address these needs, I posit that it is important to find ways to actively involve the elderly in adaptation research and planning to better understand their vulnerability in the context of climate change and to develop strategies to enhance their resilience.

In an effort to promote adaptation planning in the Northeast and beyond that addresses the needs of elderly populations, this dissertation presents the results of a participatory research and adaptation planning process conducted in partnership with the elderly community of Bridgeport, Connecticut. The goals of this research were to:

- Develop a detailed picture of this elderly community's vulnerability to climate change.
- Prioritize their concerns related to this vulnerability.
- Develop adaptation strategies to enhance their resilience to climate change.
- Evaluate the effectiveness of the process at enhancing the elderly community's resilience.
- Draw out lessons learned to inform future participatory planning efforts.

The literature review presented in Chapter Two describes the relevant background understanding and research associated with the vulnerability of the elderly to climate related stressors. Drawing from previous research in a variety of fields, it presents important factors that can contribute to the vulnerability of the elderly. Based on recent climate predictions, it also describes potential challenges that changes in climate might pose for the elderly. Furthermore, it highlights key gaps in our understanding that the current research attempts to address.

Chapter Three describes the research methods employed in this process. It begins by highlighting the adaptation planning model and the community-based action research approach that guided the research methodology. Following this framework, it offers a brief description of the study site and outlines the main activities and associated methods employed in the research process.

Chapter Four, *Developing an In-depth Understanding of the Elderly's Vulnerability to Climate Change Through a Participatory Approach*, describes the elderly participants' efforts to examine their own vulnerability to climate change and prioritize their concerns. Over the course of two meetings, participants identified numerous personal attributes, including health, economic, and social characteristics, that interact with a range of contextual factors to influence the elderly population's vulnerability to climate change. Participants also highlighted some of the key challenges that climate change may pose and, using a Likert scale survey, prioritized their primary concerns.

Chapter Five, *Using Participatory Climate Change Adaptation Planning to Promote Resilience Among the Elderly*, describes the adaptation strategies developed and prioritized by participants as well as the results of a summative evaluation investigating the project's effectiveness at enhancing their resilience. Based on the understanding of vulnerability

described in Chapter Four, participants developed a set of overarching adaptation goals and specific adaptation recommendations. With an aim at inclusively addressing a broad range of concerns, participants' goals focused on encouraging preparedness and providing community services including warning mechanisms, resources to secure safe shelter, transportation resources, resources to provide essential care during a climate related emergency, and resources to aid in the recovery process following such an event. Within the context of these goals, participants recommended the following actions:

1. Provide emergency preparedness trainings specifically for seniors.
2. Develop and distribute emergency preparedness informational materials specifically for seniors.
3. Conduct a reverse 911 sign up drive targeted at seniors.
4. Tailor warnings to meet seniors' needs.
5. Tailor shelters to meet seniors' needs.
6. Promote volunteer ridesharing and transportation assistance.
7. Establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors.

A prioritization exercise showed that participants believed all of the suggestions were likely to be effective and feasible to implement. Additionally, a summative evaluation showed the participatory planning process enhanced resilience by raising awareness and understanding, increasing communication, and strengthening elders' ability to self-advocate.

Chapter Six, *Enhancing the Resilience of Vulnerable Groups Through Participatory Climate Change Adaptation Planning: Lessons Learned from a Case Study with the Elderly Community of Bridgeport, Connecticut*, continues the evaluation to draw insights from the process as a whole by focusing on beneficial characteristics and key challenges associated with the project. Beneficial characteristics include developing a primary partnership with a local

trusted organization, connecting the subject matter with day-to-day concerns of the participants, hosting the meetings in an accessible location, using an iterative and inclusive process, collaborating with multiple organizations, and recognizing and incorporating local ongoing climate change adaptation efforts. A key challenge was accommodating the unique needs of elderly participants in the process. This was addressed through a variety of approaches to increase the accessibility and flexibility of the process to accommodate elders with a range of backgrounds, capacities, and interest levels. The potential transferability of these insights to projects in other contexts is also explored.

Chapter Seven presents final reflections in the conclusion. The key findings of the research are summarized. Additionally, it highlights the potential benefits of incorporating the elderly and other vulnerable groups directly into climate change adaptation planning processes.

Appendix A presents the final project report prepared for the city of Bridgeport and the project participants and partners. In an effort to provide resources to promote similar participatory planning efforts, Appendices B-G present the major research instruments and materials used in the process. In an effort to promote transparency and transferability, Appendices H-K present raw data from the project that does not risk compromising the anonymity of participants. Appendix L contains permission documentation.

Note on the dissertation format: Chapters Four, Five, and Six are each presented in journal article format. Each of these chapters are written as stand alone documents and contain their own abstract, introduction, methods, results and discussion, and conclusion. As a result, some of the material in earlier chapters is revisited in later chapters. To limit repetition, however, a concerted effort has been made to reference

relevant information from previous chapters in those that follow. In addition, a brief preface accompanies each chapter to place it within the context of the dissertation.

Note on language: elders and seniors. The terms elder and senior are used interchangeably in this document to refer to individuals age 65 or above. "Elder" and "elderly" are more common in the academic literature and are used most frequently herein. The term "senior" was used in place of "elder" during planning meetings, the survey, and the summative evaluation as it was in more common usage by members of the elderly community of Bridgeport.

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Chapter 2. Literature Review

Vulnerability and Climate Change in the Northeast

Climate change is predicted to significantly impact the Northeastern region of the United States. Recent events like Hurricane Irene and "Super-storm" Sandy have highlighted the region's vulnerability to climate related stressors. While it is difficult to link any one weather event to climate change, increases in a variety of climate related stressors are predicted for the area. These predicted changes include more frequent and intense precipitation events, sea level rise, and generally rising temperatures accompanied with an increase in extremely hot days (Horton et al., 2014; IPCC, 2014).

The impacts of these changes will be far ranging, affecting environmental and social systems including the economy, agriculture, human health, the cultural identity of the region, and the region's infrastructure (Frumhoff, McCarthy, Moser, & Wuebbles, 2007). Some groups within society will be more severely affected by these impacts than the general population (Figueiredo & Perkins, 2012; IPCC, 2007; Paavola & Adger, 2006). The disparate impacts of climate change are largely a result of varying levels of vulnerability among different groups. The IPCC (2007) describes vulnerability as a function of three factors:

- Exposure to climate stressors and changes.
- Sensitivity or susceptibility to damage from climate changes.
- Adaptive capacity to adjust to climate changes.

In this description, exposure to dynamic climatic stressors is exacerbated by increased sensitivity to the stressors and decreased capacity to adapt. Accordingly, vulnerability is a product of numerous factors including economic, social, geographic, demographic, cultural, institutional, governance, and environmental considerations. For example, factors including wealth, education, disability, health status, gender, and age can all play important roles influencing

sensitivity and adaptive capacity, as well as affecting exposure. Taken as a whole, the interplay of social, institutional, and economic factors heavily influence a group's ability to prepare for, respond to, and recover from climate stressors (Lynn, MacKendrick, & Donoghue, 2011).

Vulnerability and the Elderly

One group with a heightened vulnerability to climate change is the elderly (Gamble et al., 2013). The term elderly refers to individuals 65 years of age or older (Fernandez, Byard, Lin, Benson, & Barbera, 2002). Defined as such, the elderly are a very diverse group with significant variation in terms of age, race or ethnicity, socioeconomic status, and health. Given this diversity, it is important to note that elderly status is not itself a cause or indicator of vulnerability to climate change. Rather, elderly status and increasing age are associated with an increasing likelihood of certain characteristics that may heighten an individual's vulnerability to climate change either by increasing their sensitivity to the impacts or reducing their adaptive capacity. These characteristics can be loosely grouped into three categories: medical conditions and impairments, economic limitations, and social isolation (Fernandez et al., 2002).

Medical conditions and impairments. With advancing age, the probability of a range of physiological and cognitive impairments increases. Common conditions associated with increasing age include arthritis, hypertension, heart disease, diabetes, cancer, dementia, respiratory impairments, osteoporosis, and stroke (Fernandez et al., 2002; Gamble et al., 2013; Pietschmann, Rauner, Sipos, & Kerschan-Schindt, 2009). Aging is also associated with a decline in muscle strength, coordination, and balance (Eldar, 1992; Fernandez et al., 2002). Additionally, aging can lead to diminished sensory awareness and an overall decline in cognitive function (Eldar, 1992; Fernandez et al., 2002).

To manage these conditions, elderly may require regular access to health care facilities, specialized medical care and support, medical equipment, medication, and specialized nutrition (Eldar, 1992; Fernandez et al., 2002). These conditions and their required treatments, can lead to decreased mobility among the elderly (Eldar, 1992). Furthermore, as the severity of these conditions increases, elderly individuals may face significant challenges taking care of routine daily activities and coping with additional stressors (Fernandez et al., 2002).

Economic limitations. Compared to the larger population, the elderly are more likely to be unemployed and live on fixed incomes (Fernandez et al., 2002). As a result, the annual income of the elderly is significantly lower than the national average; in 2008 the median income of elderly families was $29,744 compared to an average income of $56,791 for those under 65 (US Census Bureau, 2009). In the same year, 3.7 million elderly, 9.7% of the elderly population, were living below the poverty line.

As a result, the elderly pay a higher percentage of their income on necessities such as housing, food, utilities, and medical expenses (Fernandez et al., 2002). With this higher percentage going to necessities, many elderly individuals will have limited discretionary income and ability to save. Under these conditions, they may have less of a financial buffer, a poor credit rating, and a lack of insurance (Fernandez et al., 2002). Combined, these characteristics will limit the ability of many elderly to prepare for or recover from events that may be damaging to their health or property.

Social isolation. The probability of living with a spouse or family member decreases with age (Fernandez et al., 2002). Combined with decreased mobility, the social circle of many elderly can be quite small and this can lead to social isolation. As a result, the elderly may be less likely to receive important information such as warnings or instructions regarding natural

stressors. Additionally, they may lack the social support network to help them manage stressful situations.

Climate Stressors and the Elderly

Given these conditions, there are three predicted impacts of climate change that may pose the greatest risks to elderly residents in the northeastern US. These are increases in extreme heat and heat waves, increases in flooding and storms, and decreased air quality (Gamble et al., 2013).

Extreme heat and heat waves. One of the most prominent climate change impacts in the Northeast will be an overall rise in temperatures. Climate change models predict a rise of 3 to 10^{O}F by the 2080's (Horton et al., 2014). The increase in general temperatures will be accompanied by an increase in very hot days and heat waves in the Northeast. Even by conservative estimates, the number of days over 90^{O}F is expected to double in northeastern cities by the end of the century (Horton et al., 2014). The heat island effect, a process where dark and reflective surfaces and a lack of natural materials amplify heat, will exacerbate extreme heat in cities (Frumhoff et al., 2007).

Numerous studies have shown that the elderly suffer a higher mortality rate during heat waves than the general population (Ebi & Meehl, 2007; Oudin Åström, Bertil, & Joacim, 2011; Thacker, Lee, Sabogal, & Henderson, 2008). For example, during a 2006 heat wave in New York City, more than 80% of the deaths were among individuals ages 50 or older (Frumhoff et al., 2007). Very hot days and heatwaves, defined as three consecutive days with temperatures over 90^{O}F, present significant risks for the elderly for multiple reasons (Ebi & Meehl, 2007; Gosling, Lowe, McGregor, Pelling, & Malamud, 2009; Green, Gilbert, James, & Byard, 2001;

Medina-Ramón & Schwartz, 2007; Ostro, Roth, Green, & Basu, 2009). Fundamentally, aging in general is associated with trouble regulating body temperature and so the elderly are more likely to suffer heat related illnesses and mortality (Gamble et al., 2013). The sensitivity of elderly individuals to extreme heat can be exacerbated by particular illnesses including diabetes and certain cardiovascular issues, such as heart disease and hypertension (Worfolk, 2000). A variety of medications that the elderly might take, including beta blockers for treating high blood pressure, pulmonary disease drugs, and psychotropic medications, also increase the risks of illness and death associated with extreme heat (CCSP, 2008; Ebi & Meehl, 2007; Knowlton et al., 2009; Luber & McGeehin, 2008; Worfolk, 2000).

In addition to health related issues, there are a variety of other factors that can increase elderly individual's vulnerability to extreme heat. Financial limitations may prevent elderly individuals from owning, purchasing, or operating an air conditioner during hot weather. Social isolation and diminished sensory awareness may prevent individuals from receiving warnings about upcoming hot weather or information about the location of cooling centers or other types of assistance. Even if they hear about upcoming hot weather, decreased mobility may prevent them from taking actions to protect themselves, such as buying an air conditioner or going to a cooling center. Socially isolated elderly may also be at risk because they will not have an adequate support structure of people to check on and assist them during the hot weather (Health Canada, 2011). Finally, a lack of social services can make hot weather even more challenging for the elderly. For example, insufficient warning, a lack of cooling centers, or inadequate public transportation to bring residents to and from the cooling centers, can all put elderly who depend on these resources at increased risk.

Flooding and storms. Along with changes in temperature, the frequency and intensity of heavy-precipitation events is predicted to increase. By conservative estimates the number of heavy-precipitation events, defined as events with more than two inches of rainfall in a 48 hour period, are projected to double by the end of the century (Walsh et al., 2014). These changes in precipitation could lead to increased flooding that could pose risks to the health, safety, and property of the elderly.

For coastal areas, sea level rise will compound the risk of flooding and its associated impacts. By the end of the century, conservative models predict a rise in sea levels of between one to four feet (Walsh et al., 2014). As a result of this rise, stormwater will have less opportunity to drain during a heavy-precipitation event. Additionally, sea level rise will result in greater storm surges associated with coastal storms like hurricanes and Nor'easters.

In the case of powerful storms like hurricanes, the flooding will likely be associated with additional difficulties including high winds, debris, and power outages. Researchers currently debate whether or not climate change will result in increased frequency or intensity of hurricanes, but some studies support that warming ocean temperatures appear to be increasing the intensity of hurricanes in the Atlantic Ocean (Ekwurzel, 2006; Emanuel, 2005; Villarini & Vecchi, 2013; Webster, Holland, Curry, & Chang, 2005). If this is the case, such an impact could pose serious risks to elderly communities living in coastal locations.

The elderly will likely face multiple challenges preparing for, coping with, and recovering from flooding and storms. Financial limitations may prevent them from taking steps to weatherize their home and property to withstand flooding and high winds (Browning, Wallace, Feinberg, & Cagney, 2006; Tierney, Petak, & Hahn, 1998). Social isolation and diminished sensory awareness may prevent them from receiving information, including warnings

or instructions about predicted events (Rosenkoetter, Krassen-Covan, Bunting, Cobb, & Fugate-Whitlock, 2007). Decreased mobility, diminished sensory awareness, and other physiological and cognitive limitations may make it difficult for the elderly to evacuate before or during a flood or storm. For elderly individuals who cannot or choose not to evacuate, storms may damage homes exposing the elderly to increased heat or cold.

Storms may disrupt key infrastructure including electricity, telephone, or transportation. Without electricity, the elderly may be without important medical devices and aids including ventilators, and electric wheelchairs. A loss of electricity could also result in no heat or refrigeration, which would be hard for many elderly as they have decreased mobility and trouble regulating body temperature. A lack of electricity could also result in no water or elevators in high-rise buildings and no ability to charge cell phones. For elderly unable to use the stairs, this could trap them in their houses; and without cell phones or other communication, elderly individuals may have trouble contacting family or other support providers to ask for needed assistance. These challenges could be exacerbated if the storm also disrupts transportation infrastructure. If roads are blocked by flooding, washouts, or downed trees, the elderly may be unable to access medical facilities for treatment or medications (Frumkin, 2002). These issues may also prevent care providers from reaching and caring for the elderly during and following a disaster (Fernandez et al., 2002).

Recovering after the storm can also present challenges for the elderly. Mold from flooding may pose significant health risks to elderly individuals with respiratory diseases (Gamble et al., 2013). If they are on a fixed income or without insurance, they may have trouble repairing damage to their property. Numerous studies also show that, compared to the general population, the elderly receive less financial and psychological support following disasters (Ngo

2001; Fernandez et al., 2002). This could be because they are less inclined to request it and generally under utilize recovery support programs (Cohen & Poulshock, 1977; Huerta & Horton, 1978; Kilijanek & Drabek, 1979). It could also be because they have difficulty navigating the complex processes to request assistance (Fernandez et al., 2002).

Decreased air quality. Climate change is predicted to lead to higher levels of tropospheric ozone and fine particulate matter (CCSP, 2008; IPCC, 2007; Luber et al., 2014). This will occur as a result of three factors (Luber et al., 2014). First, warmer temperatures will accelerate ozone forming chemical reactions in the atmosphere. Second, predicted increases in the frequency and duration of periods of air stagnation will allow pollution to accumulate in certain areas. Third, a longer growing season and warmer weather will promote greater plant emissions of natural ozone precursors (Luber et al., 2014).

As a result, fewer days will meet national air quality standards. Researchers predict that, even under conservative estimates, the number of days exceeding the EPA's 8-hour ozone standard will increase by 50% or more (Frumhoff et al., 2007). Air pollution will be especially challenging in cities and will pose an even greater threat to health if future levels of vehicle emissions and industrial pollution are not reduced below today's levels. As climate change will likely encourage plant growth in the Northeast, human sources of air pollution may also be accompanied by increases in pollen and other allergens (Frumhoff et al., 2007).

Compared to the general population, older adults are more likely to have breathing impairments and, as a result, to be more sensitive to the adverse health impacts of these changes in air pollution (Gamble et al., 2013). Even for elderly individuals without respiratory challenges, physiological changes may cause impaired breathing and heightened sensitivity to air pollutants (Wang, Green, Smiley-Jewell, & Pinkerton, 2010). Air pollution can also exacerbate

many other medical conditions the elderly may have, including diabetes and cardiopulmonary illness, possibly leading to heart attack and premature mortality (Baja et al., 2010; Laumbach, 2010; Park, O'Neill, Vokonas, Sparrow, & Schwartz, 2005).

Contextualizing factors. For each of these stressors, it is important to note that a variety of contextual factors can play an important role in mitigating or exacerbating the risks to the elderly. Many of these factors are dependent on the institutional preparedness of the municipality to manage the stressors. For example, adequate warnings and instructions before an event can help the elderly take effective actions to protect themselves. Adequate public transportation can help the elderly evacuate or access vital resources like shelters, cooling centers, medical care facilities, or grocery stores. Adequate ability to accommodate and care for individuals in shelters, cooling centers, and medical facilities is also important to ensure that the elderly can receive the care they need (Fernandez et al., 2002). Safe and well maintained neighborhoods are also important to make the elderly feel comfortable leaving their homes to seek needed help (Browning et al., 2006). Following a flood or storm, adequate financial and psychological support services are important to help the elderly recover. These supports could include free temporary housing, low interest loans, health care services, transportation assistance, as well as counseling and other mental health services.

It is important to note that poverty, illiteracy, and a lack of formal education can severely limit the adaptive capacity of elderly individuals (Gamble et al., 2013). Race and ethnicity can also play a role in marginalizing the elderly and limiting their access to money and formal education (Gamble et al., 2013). For example, poor, marginalized, undereducated elderly will generally be more at risk to the impacts of climate change because they are more likely to live in poor quality housing and may be less knowledgeable of support services and how to utilize them.

Gaps and Concerns

This understanding of the elderly's vulnerability to climate related stressors, drawn largely from the fields of health, disaster management, and natural hazard mitigation, is a valuable resource for efforts to protect the elderly from the impacts of climate change. It presents us with many of the possible factors that can contribute to the vulnerability of the elderly. It also offers insight into some influences that may exacerbate or mitigate their vulnerability. All of the original research on which this understanding is based, however, was conducted in the context of historical climatic stressors. There has been very little research conducted on the vulnerability of the elderly in the context of emerging climate change. Researchers have yet to fully explore how to examine vulnerability, including both sensitivity and adaptive capacity to climate change, among actual elderly communities. As a result, there are multiple gaps in our current understanding of the elderly's vulnerability to climate change.

In the context of climate change, climatic stressors will be dynamic over time, not static. Over the course of the next century, most models predict that the major stressors affecting the elderly will increase in intensity, range, duration, or frequency (IPCC, 2014). In addition to the dynamic nature of climate related stressors under climate change, the impacts of these stressors will also be interconnected. This interaction may exacerbate some of the impacts of certain stressors and will likely cause additional challenges for the elderly. As a result, the challenges that the elderly face may be compounded in unprecedented ways.

Also, as these impacts increase and interact over time, it is unclear how the elderly's adaptive capacity may be able to respond to the new and changing conditions. The range of adaptive responses of some elderly individuals may be limited due to a lack of economic

resources or by reluctance to making significant changes such as moving to a new home. Limitations like these may prevent the elderly from undertaking more significant adaptive actions, such as relocation or major capital improvements to their property, that are needed to reduce their vulnerability to the more severe impacts of climate change.

It is also worth noting that much of the existing literature on the elderly's vulnerability to climate change focuses on factors that increase their sensitivity and limit their adaptive capacity (for example see Gamble et al. (2013)). Researchers have devoted less attention to factors that might enhance adaptive capacity. There also has been little research into adaptive resources that the elderly currently employ and might be able to draw upon in adapting to climate change. To more fully understand the overall vulnerability of the elderly to climate change and work to reduce it, it is important to consider their existing resources and current coping strategies.

In addition to a limited understanding of the elderly's adaptive capacity, we also have little understanding of the elderly's concerns, needs, and priorities relative to climate change. Most research in this area has viewed the elderly as research subjects and has focused primarily on determining possible causes of their vulnerability (Gamble et al., 2013). Little research has sought to incorporate the opinions or perspectives of the elderly with regard to climate change or to involve them as active participants in shaping that research to ensure that it addresses their concerns.

Implementing adaptation strategies to reduce the vulnerability of the elderly will take a concerted effort involving local governments, elderly support organizations, the elderly themselves, as well as their friends and family, and the larger communities in which they live (Gamble et al., 2013). As these groups seek to effectively coordinate their adaptation planning, the lack of understanding about the vulnerability of the elderly in the unique context of climate

change could hinder their efforts. Exacerbating this lack of understanding, the elderly, especially the most vulnerable among them, may often lack a voice in climate change adaptation planning conducted at city, state, regional, and national levels. On a more general stage, elderly citizens have had some success in self-advocacy that they could draw from to advocate for their needs in the context of climate change (Brown, 1985). The ability of some elderly to self-advocate, however, has been shown to be dependent on many factors including gender, education, and marital status (Anthony, 2006). These factors could prevent the most vulnerable elderly from voicing their needs. More fundamentally, research has shown that underlying beliefs about the elderly as having a limited potential for growth and community engagement may hinder efforts to promote autonomy among them (Cohen, 1990). I contend that these underlying beliefs also contribute to the marginalization of the elderly, making it harder for them to self-advocate in the context of climate change.

While I am unaware of any research that has focused specifically on the topic of elderly self-advocacy in climate change adaptation planning, several factors may further marginalize the elderly in this context. Elderly individuals lacking scientific or planning backgrounds may not be invited to participate in a climate change adaptation planning process. Decreased mobility and physiological or cognitive limitations may make it difficult for elderly individuals to attend adaptation planning meetings. Furthermore, without scientific or technical expertise on the topic, they may not view themselves as able to contribute to climate change adaptation planning. Challenges including diminished sensory awareness or cognitive limitations might also make some elderly reluctant to participate if they felt that it would be hard for them to follow or contribute to the meeting.

Without a refined understanding of the elderly's vulnerability to climate change and the inclusion of their voices in the planning process, there is the potential that adaptation efforts will fail to address their needs. To ensure that the vulnerability of the elderly is effectively addressed in climate change adaptation, I posit that it is vital to develop our understanding of vulnerability among the elderly by studying vulnerability to climate change among actual elderly communities. I also contend that it is vital that we develop and utilize approaches for bringing the voices of the elderly into larger community-wide planning processes.

Research Focus

To improve our understanding the vulnerability of the elderly to climate change, and to foster adaptation planning in the Northeast and beyond that effectively incorporates their concerns and priorities, my dissertation research focuses on these primary questions:

- How might climate change impact the elderly and what are causes of vulnerability to climate change among the elderly?
- What aspects of their vulnerability to climate change are the elderly most concerned about?
- What are the elderly's preferred strategies for enhancing their resilience to climate change?
- Can a participatory adaptation planning process enhance the resilience of the elderly and, if so, in what ways?
- What are beneficial characteristics and key challenges when working with the elderly on climate change adaptation planning?

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Chapter 3: Methods

Methodological Framework

To investigate these questions, I conducted this doctoral research as a case study of a participatory climate change adaptation planning project with elders from the community of Bridgeport, Connecticut. I conducted the project and the associated research in the spirit of community-based action research (CBAR). The primary focus questions restated in the specific context of this research are:

- How might climate change impact the elderly in Bridgeport, Connecticut, and what are causes of vulnerability to climate change among that community?
- What aspects of their vulnerability to climate change are the elderly community of Bridgeport most concerned about?
- What are the elderly community of Bridgeport's preferred strategies for enhancing their resilience to climate change?
- Can a participatory adaptation planning process enhance the resilience of the elderly in Bridgeport and, if so, in what ways?
- What are beneficial characteristics and key challenges when working with the elderly on climate change adaptation planning in Bridgeport?

A participatory adaptation planning process is useful for investigating these questions as it offers a well-developed approach for examining vulnerabilities and developing adaptive strategies (Cloutier & Joerin, 2012; Dumaru, 2010; Frazier, Wood, & Yarnal, 2010). Adaptation to climate change is defined by the IPCC (2001) as "adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities." As described in the NRC's (2010) *Adapting to the Impacts of Climate Change,* adaptation consists of six primary steps:

1) Identify current and future climate changes relevant to the system.
2) Assess the vulnerabilities and risk to the system.
3) Develop an adaptation strategy using risk-based prioritization schemes.
4) Identify opportunities for co-benefits and synergies across sectors.

5) Implement adaptation options.
6) Monitor and reevaluate adaptation options.

For this research, I proceeded through these climate change adaptation steps using a participatory process conducted in collaboration with members of the elderly community of Bridgeport, Connecticut. I relied on the principles of community-based action research (CBAR) as a methodological guide for including the elderly as participants in the research. In his 2007 edition of the book *Action Research*, prominent researcher E. T. Stringer defines CBAR as a "collaborative approach to inquiry or investigation that provides people with the means to take systematic action to resolve specific problems." In particular, I followed CBAR's emphasis on upholding a spirit of cooperation and equity, examining issues within their context, recognizing the validity of multiple ways of knowing, and fostering action to address issues of community concern (Strand, Cutforth, Stoecker, Marullo, & Donohue, 2003; Stringer 2007). I utilized also Stringer's (2007) five-step CBAR model in carrying out the research:

1. Establish a relationship between the researcher and stakeholder group.
2. Build a picture of the issue under investigation.
3. Interpret and analyze the issue.
4. Take action.
5. Report.

In integrating CBAR principles with an adaptation planning process, this dissertation is grounded in existing research on the topic of participatory climate change adaptation. While rarely referring explicitly to CBAR, numerous researchers have incorporated participation into climate change adaptation by employing approaches largely consonant with those of CBAR (Cloutier & Joerin, 2012; Dumaru, 2010; Frazier et al., 2010). In this research, they have highlighted the need for participatory climate change adaptation to focus on vulnerable populations, increase awareness of climate change risks, consider current vulnerabilities as a

context for understanding future vulnerabilities, and empower communities to make adaptation decisions (Dumaru, 2010; Ford & Smit, 2004). In these projects, they have also found that incorporating public participation into adaptation planning can provide multiple benefits, such as increasing participants' understanding of the issues, identifying key vulnerabilities, creating collectively acceptable adaptation strategies, enhancing institutional capacity within communities, and connecting communities to outside resources to aid in adaptation (Albert, Zimmermann, Kneiling, & von Haaren, 2012; Gero, Meheux, & Dominey-Howes, 2011).

This research sought to apply and build on this body of research to understand how climate change may impact a specific vulnerable group within a larger community. While community-wide adaptation planning processes are helpful in understanding and addressing a community's vulnerability to climate change, they might not be the optimal venues for specific vulnerable groups within a community to meet their needs. Numerous studies have shown that community-wide participatory processes can favor those with greater political influence and tend to prioritize commonly held priorities and concerns over needs held only by specific groups (Agarwal, 1997; Buchy & Hoverman, 2000; Cornwall, 2003; Lennie, 1999; Mohatny, 2002; Strachan & Peters, 1997). Both of these factors could lead to the needs of the elderly population not being fully explored and addressed in a community-wide process. To address this potential shortcoming, I collaborated specifically with the elderly community of Bridgeport to develop their understanding of their vulnerability to climate change, determine their needs and concerns related to the topic, and then share their resulting recommendations with the relevant city agencies in an effort to have them addressed.

It is important to note that, as with the above referenced participatory adaptation projects, this research cannot be considered CBAR in the strictest sense. It differed from a pure CBAR

project in two main ways. First, while in CBAR the participants usually play a key role in developing the research question, in the current research the overarching questions were largely set in advance in an effort to align the research with the current theory and practice associated with climate change adaptation planning. Despite this predetermination, the research process itself was designed to be flexible and responsive to the needs and concerns of the participants. Second, while in CBAR the participants are fully involved in data collection and analysis, for the sake of confidentiality among the participants, I collected the data at various stages, summarized it, and presented summaries to the group for their review.

Given these limitations, this research can be best understood as a case study of a participatory adaptation planning process rooted in the spirit of CBAR and utilizing a CBAR framework. In defining case study research, prominent researcher Robert K. Yin (2009) highlights its role as "an empirical inquiry that investigates contemporary phenomenon in depth and within its real life context, especially when the boundaries between phenomenon and context are not clearly evident." He goes on to add that, as a method of inquiry, case study research "relies on multiple sources of evidence." This research fits comfortably within this definition and these aspects of case study research informed the data collection and analysis as well as the reporting of the case.

Site Description

The city of Bridgeport, which is located in southwestern Connecticut on Long Island Sound, has many attributes that make it an advantageous location for this research (Figure 1). Bridgeport has a large and diverse elderly population comprising 16,000 people or 10% of the city's population (US Census Bureau, 2010). Three senior centers service an elderly community

encompassing a broad range of socioeconomic conditions and ethnic backgrounds (US Census Bureau, 2010) (Table 1). Additionally, Bridgeport is predicted to experience multiple climatic stressors including increased extreme temperature days, sea level rise, increased high precipitation events, and decreased air quality (Horton et al., 2014). Previous climate related stressors experienced by the elderly community in Bridgeport, including strong storms and heat waves, serve as effective precedents to inform the participants' exploration of their existing vulnerability and coping capacities. In addition to the opportunity and need for this research, there is the additional potential to integrate the findings of the project with ongoing adaptation planning being conducted by the city (City of Bridgeport, 2012).

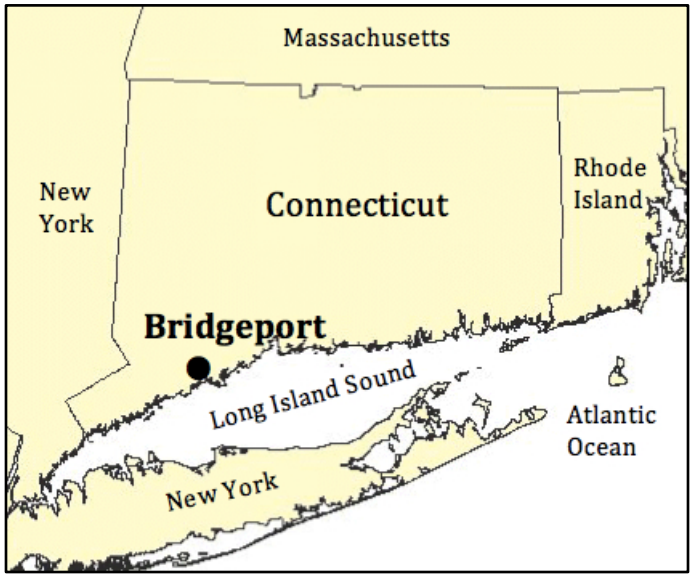

Figure 1. Map showing the location of Bridgeport, Connecticut. Base map prepared by the State of Connecticut Department of Energy and Environmental Protection (2013) and is in the public domain.

Table 1. *Demographic breakdown of the elderly population of Bridgeport.*

Category	**Elderly population in Bridgeport**
Age (Average)	74.2
Gender (%)	
Female	60.8
Male	39.2

Race (%)	
Asian	2.8
Black or African American	28.3
White	63.3
Other	5.6
Hispanic or Latino (%)	22.1
Living Alone (%)	59.9
Educational Attainment (%)	
Less than a High School degree	41.3
High School degree or equivalent	34.1
Some college/associates degree	14.6
Bachelors degree or higher	10.1
Living With a Disability (%)	41
Speak English less than very well (%)	29
Employment (%)	
Full or part time	15.9
Unemployed or retired	84.1
Housing status (%)	
Owner occupied	55.6
Renter occupied	44.4

Note: Data taken from US Census Bureau (2012).

Due to its focus on a single community, this research will not be generalizable to the larger elderly population. Some of its findings, however, may be transferable to other elderly communities. Additionally, grounding the research in one community can be an effective tool for conducting collaborative research to help a community better understand and take action on a specific issue (Stringer, 2007).

Research Protocol

To structure the research process, I overlaid the first four steps of the NRC (2010) planning process with the five-stage CBAR model developed by Stringer (2007) (Table 2). The combined research protocol was:

1. Establish a relationship between the researcher and the elderly community.

2. Determine the relevant climate stressors.
3. Gather data on the vulnerability of the elderly community to those stressors.
4. Analyze the vulnerability data and determine the most significant causes of vulnerability to address.
5. Develop and prioritize climate change adaptation plans.
6. Share adaptation plans with the municipality to look for opportunities for collaboration and implementation.
7. Conduct summative evaluation and draft a formal report of the research for the community partners and a dissertation for the University partner.

Due to time and resource constraints, the research did not fully continue on to the NRC steps five (implementing adaptation options) and six (monitoring and reevaluating adaptation options). One of the goals of this research, however, was to lay the groundwork in terms of planning, communication, and leadership to empower the elderly community to continue on to the implementation phase.

Table 2. *Research process and associated steps in the Stringer and NRC models.*

<table>
<tr><th>Steps in research process</th><th>Associated step in Stringer CBAR model (2007)</th><th>Associated step in NRC adaptation planning model (2010)</th></tr>
<tr><td>1) Establish a relationship between the researcher and the elderly community</td><td>1) Establish a relationship between the researcher and stakeholder group</td><td></td></tr>
<tr><td>2) Determine the relevant climate stressors</td><td rowspan="2">2) Build a picture of the issue under investigation</td><td>1) Identify current and future climate changes relevant to the system</td></tr>
<tr><td>3) Gather data on the vulnerability of the elderly community to those stressors</td><td rowspan="2">2) Assess the vulnerabilities and risk to the system</td></tr>
<tr><td>4) Analyze the vulnerability data and determine the most significant causes of vulnerability to address</td><td>3) Interpret and analyze the issue</td></tr>
<tr><td>5) Develop and prioritize climate change adaptation plans</td><td rowspan="2">4) Take action</td><td>3) Develop an adaptation strategy using risk-based prioritization schemes</td></tr>
<tr><td>6) Share adaptation plans with the municipality to look for opportunities for collaboration and implementation</td><td>4) Identify opportunities for co-benefits and synergies across sectors</td></tr>
<tr><td>7) Conduct evaluation and draft a formal report of the research and the dissertation</td><td>5) Report</td><td></td></tr>
</table>

Before the research began, a proposal was reviewed by Antioch University New England's Institutional Review Board. Following the completion of the review, the research was conducted over one year. It took place as a series of meetings with additional data collection and analysis. The different steps in the process and the associated activities yielded insights into the primary research questions (Table 3). Steps two and three focused on the first research question: How might climate change impact the elderly in Bridgeport, CT and what are causes of vulnerability to climate change among that community? Step four focused on the second question: What aspects of their vulnerability to climate change are the elderly community of Bridgeport most concerned about? Step five explored the third research question: What are the elderly community of Bridgeport's preferred strategies for enhancing their resilience to climate change? Step six provided insight into my fourth and fifth research questions: Can a participatory adaptation planning process enhance the resilience of the elderly in Bridgeport and, if so, in what ways? and What are beneficial characteristics and key challenges when working with the elderly on climate change adaptation planning in Bridgeport?

As Table 3 illustrates, each step in the research process was associated with specific activities. I will provide an overview of each of these activities and the associated methods here and more detailed descriptions can be found in the methods sections of the associated chapters.

Table 3. *Steps in the research process with associated activities and research questions.*

<table>
<tr><th>Step in Process</th><th>Related Activity</th><th>Research Question Investigated</th><th>Associated Chapter in Dissertation</th></tr>
<tr><td>1) Establish a relationship between the researcher and stakeholder group</td><td>Community outreach and initial Advisory Committee meeting</td><td></td><td></td></tr>
<tr><td>2) Determine the relevant climate stressors</td><td>1st vulnerability assessment meeting</td><td rowspan="2">How might climate change impact the elderly in Bridgeport, CT and what are causes of vulnerability to climate change among that community?</td><td rowspan="3">Chapter 4</td></tr>
<tr><td>3) Gather data on the vulnerability of the elderly community to those stressors</td><td>2nd vulnerability assessment meeting</td></tr>
<tr><td>4) Analyze the vulnerability data and determine the most significant causes of vulnerability to address</td><td rowspan="2">Survey distribution and analysis</td><td>What aspects of their vulnerability to climate change are the elderly community of Bridgeport most concerned about?</td></tr>
<tr><td>5) Develop and prioritize climate change adaptation plans</td><td>1st adaptation planning meeting</td><td>What are the elderly community of Bridgeport’s preferred strategies for enhancing their resilience to climate change?</td><td rowspan="3">Chapter 5</td></tr>
<tr><td>6) Share adaptation plans with the municipality to look for opportunities for collaboration and implementation</td><td rowspan="2">2nd adaptation planning meeting</td><td rowspan="2">Can a participatory adaptation planning process enhance the resilience of the elderly in Bridgeport and, if so, in what ways?</td></tr>
<tr><td>7) Conduct evaluation and draft a formal report of the research and the dissertation</td><td>Summative evaluation</td><td>What are beneficial characteristics and key challenges when working with the elderly on climate change adaptation planning in Bridgeport?</td><td>Chapter 6</td></tr>
</table>

Community outreach and initial advisory committee meeting. The first step in the research process was to reach out to the elderly community of Bridgeport and the relevant institutions and organizations that support them. Initially, I contacted the Bridgeport Department

on Aging to partner with them on the research. Together, we formed an advisory committee consisting of representatives from key municipal agencies including the Department on Aging, the Office of Emergency Management and Homeland Security, and the Office of Sustainability. In addition, the Department on Aging selected eight members of the elderly community to participate on the Advisory Committee. In selecting these individuals, the Department on Aging sought out representatives who were active in the elderly community and who came from a diverse range of socioeconomic backgrounds. We held a pre-project meeting to solicit the Advisory Committee's input on the project design and outreach. Our goal was to foster an adaptation planning process that effectively incorporated the perspectives of a diverse representation of Bridgeport's elderly community. Based on their suggestions we developed an outreach strategy to target the prominent socio-economic subgroups within the elderly community of Bridgeport. To this end, we then reached out to elderly community members through the city's three senior centers. As the Advisory Committee explained, different socio-economic subgroups within the elderly community are divided by neighborhood. Each senior center reaches and serves a different subgroup. By working through these multiple outreach venues, the Advisory Committee was confident that a diverse cross-section of the elderly community could be encouraged to participate in the project. Demographic data was collected from participants at all of the following meetings and also as part of the survey to ensure that the process was indeed incorporating a diverse range of Bridgeport's elders.

First vulnerability assessment meeting. Following outreach from the senior centers to encourage diverse participation in the project among the elderly community, we held the first vulnerability assessment meeting at Bridgeport's main senior center. The meeting was an hour and a half in duration and was open to any members of the elderly community of Bridgeport who

wished to attend. At the beginning of the meeting, I gave a brief presentation about the historical climate trends in Bridgeport, which was followed by a conversation about the relevance of these trends to the elderly community of Bridgeport. Based on this discussion, the participants divided into small working groups to discuss their current vulnerability to one of three specific types of climate related stressors: heat waves and extremely hot days, flooding and storms, and air pollutants and allergens. In these groups, participants engaged in antecedent and consequence mapping to explore the potential cause and effect relationships associated with their vulnerability (Stringer, 2007). Through these self-facilitated discussions, participants focused on three questions:

- How are you currently impacted by the given climate stressor?
- What factors contribute to your vulnerability to the given stressor?
- What approaches do you currently employ to prepare for, cope with, or recover from the given stressor?

At the conclusion of the meeting, each group reported out the results of their discussions and members of other groups had the opportunity to contribute additional responses.

Second vulnerability assessment meeting. Following this initial meeting, we held a second meeting at the main senior center to explore the implications of predicted climate change. At the beginning of the meeting, participants reviewed a summary of the first meeting and offered additional comments. Next, participants reviewed recent climate change predictions for each of the primary climate related stressors under investigation and discussed how these changes might impact the elderly in Bridgeport. We then used the picture of vulnerability developed so far to create a five-point Likert scale survey on which elderly citizens of Bridgeport could rank their level of concern over various contextual factors that contributed to their vulnerability.

Survey distribution. Based on the recommendations of the participants, and in order to reach a diverse sample of Bridgeport's elderly including high-need segments of the population, surveys were distributed by multiple local organizations including the Bridgeport Department on Aging's three senior centers, CW Resources' Meals on Wheels Program, St Vincent's Medical Center, the Bridgeport YMCA, the Stratford Visiting Nurses Association, and local houses of worship. Both English and Spanish language versions of the survey were distributed. Demographic data was collected from a random subset of one in five surveys.

Survey analysis. Survey results were analyzed to note respondents' average level of concern over each item. In addition to recording the average level of concern over each question, specific concerns held by minority sub-groups within the elderly community were also recorded.

First adaptation planning meeting. Once the data analysis was complete, we held an initial adaptation planning meeting at Bridgeport's main senior center. At the beginning of the meeting, the elderly participants reviewed the results of the survey. Then, in response to this information, they began to develop adaptation goals and strategies to enhance their resilience. Their efforts in this regard were informed by the adaptation planning approaches and best practices described in Gruber et al. (2015), the NRC (2010), and Snover et al. (2008). Initially, participants developed general guiding goals for the adaptation effort and then developed specific recommendations designed to further those goals.

Second adaptation planning meeting. At the beginning of the second adaptation planning meeting, participants reviewed and revised the adaptation recommendations developed at the previous meeting. Participants, including members of the elderly community and attending city staff, then prioritized these actions based on their potential positive impact for

reducing risk among the elderly as well as their potential feasibility of implementation. Participants ranked impact and feasibility on a Likert scale of one to five with one representing an option with low potential impact or feasibility and five representing an option with high potential impact or feasibility. Impact and feasibility assessments were averaged separately for the participating elders, the participating staff, as well as for the whole group.

Summative evaluation. At the conclusion of the project, a summative evaluation was conducted. The summative evaluation had two primary objectives. The first objective was to assess the project's outcomes in terms of enhancing the elderly community of Bridgeport's resilience to climate change. The second objective was to identify beneficial characteristics and key challenges of the process. The project outcomes were assessed based on the following factors:

- Do the elderly participants believe that the adaptation recommendations reflect the needs and concerns of the elderly?
- Do the elderly participants believe that the adaptation recommendations will help keep Bridgeport's seniors safer?
- How are the elderly participants' adaptation recommendations received by public officials of the city of Bridgeport and what is the likelihood of the city moving forward with implementation?
- Did the project improve the elderly participants' awareness of the risks posed by climate change?
- Did the project increase the elderly participants' knowledge about what actions they could take to protect themselves?
- Did the project enhance the elderly participants' ability to self-advocate for their needs?
- Did the project increase the awareness among relevant support groups of the risks that climate change poses for the elderly in their community?
- Did the project lead to increased communication among those groups regarding efforts to protect the elderly community from those risks?

In investigating these questions, a combination of methods was utilized. Participant observation was conducted by the lead researcher throughout the process, and Likert scale survey

questions, semi-structured interviews, and semi-structured focus group interviews were employed at the conclusion of the process (Davidson, 2005; Patton, 1987). Participant observation, semi-structured interviews, and semi-structured focus group interviews were also used to identify beneficial characteristics and key challenges of the project. Open coding was used to categorize important themes from these data sources within these the topics of beneficial characteristics and key challenges (Strauss & Corbin 1998). The results of the evaluation were shared with the elderly participants and representatives from the relevant support groups for their review. Their input was included in the final assessment.

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Preface to Chapter 4

Chapter Four is written in journal article format. It focuses on the two initial vulnerability assessment meetings and the related survey investigating the elderly's concerns about climate change. Specifically, it addresses the following primary research questions:

- How might climate change impact the elderly in Bridgeport, CT and what are causes of vulnerability to climate change among that community?
- What aspects of their vulnerability to climate change are the elderly community of Bridgeport most concerned about?

Chapter Four begins with an introduction that highlights the disproportionate impacts climate change will have on the elderly and presents the need for additional research focused on the vulnerability of the elderly to climate change. The methods section provides a general description of the study site and explains the research process associated with the two vulnerability assessment meetings and the accompanying survey. The results and discussion section presents the picture of their vulnerability developed by the elderly participants over the two meetings. The results and discussion section also describes the results of survey analysis indicating the elderly's most pressing climate related concerns.

Chapter 4: Developing an In-depth Understanding of the Elderly's Vulnerability to Climate Change Through a Participatory Approach

Abstract

Recent reports highlight the vulnerability of the elderly to the impacts of climate change, yet limited research has focused on this topic. To develop an in-depth picture of the vulnerability of the elderly to climate change, this paper presents the results of a case study conducted in collaboration with the elderly community of Bridgeport, Connecticut. Elderly participants explored their vulnerability to current and predicted climate stressors with a focus on extreme heat, flooding and storms, and air pollution. This research identifies multiple personal characteristics that interact with a range of contextual factors to influence the elderly population's vulnerability to climate change. As a result of the interplay of these characteristics and factors, the research suggests that predicted changes in climate for the area could have potentially serious consequences for Bridgeport's elderly population. This study also illustrates the diversity of concerns among the elderly community regarding climate change and extreme weather. The issues and concerns highlighted in this study may bear similarities to other locations, especially urban settings facing similar climate stressors and with similar socioeconomic conditions. These findings suggest a need for further research into the elderly's vulnerability to climate change in order to improve our understanding and serve as the basis for collaborative adaptation planning that engages elderly communities with local governments and a broad coalition of partners to keep elders safe.

Introduction

Social vulnerability to climate change in the United States. Climate change is predicted to significantly impact the United States. Events like "Super-storm" Sandy and the

ongoing drought in the western US have highlighted the nation's vulnerability to weather related stressors. According to the National Hurricane Center, Super-storm Sandy alone is estimated to have resulted in 147 deaths and caused $50 billion in damage in the United States (Blake, Kimberlair, Berg, Cangialosi, & Beven, 2013). While it is difficult to link any one weather event to climate change, these events are consistent with climate predictions for those areas. Climate change predictions include more frequent and intense precipitation events in the Northeast, increased heatwaves in the Midwest, decreased water availability in the Southeast, and drought in the Southwest (IPCC, 2014; Melillo, Richmond, & Yohe, 2014).

While varying by region, the impacts of these changes will be far ranging, affecting the environment, economy, agriculture, human health, cultural identity, and infrastructure (Melillo et al., 2014). Some groups within society are more vulnerable to these changes and will bear a disproportionate burden of their impacts (Figueiredo & Perkins, 2012; IPCC, 2007; Paavola & Adger, 2006). The uneven distribution of climate impacts, sometimes referred to as the "climate gap," is rooted in varying levels of vulnerability to climate change among different individuals and groups.

In their *Fourth Assessment Report*, the IPCC (2007) defines vulnerability as a function of three characteristics:

- Exposure: the character, rate, and magnitude of climate change to which a system, individual, or population is exposed.
- Sensitivity: the sensitivity or susceptibility to damage from those changes.
- Adaptive capacity: the capacity to adjust to changes in climate in order to moderate potential damage, take advantage of opportunities, or cope with consequences.

In this understanding, exposure to climatic stressors is exacerbated by increased sensitivity to those impacts and decreased capacity to adapt. For human populations, both sensitivity to

climate impacts and adaptive capacity are influenced by economic, social, geographic, demographic, cultural, institutional, governance, and environmental factors. As a result, vulnerability is associated with inequalities expressed through varying levels of wealth, education, disability, access to resources, health status, gender, and age, as well as marginalization and cultural characteristics. The interplay of these factors determines what is often referred to as an individual's or a group's relative level of "social vulnerability" by influencing their ability to prepare for, cope with, and recover from climate stressors (Lynn, MacKendrick, & Donoghue, 2011).

Vulnerability and the elderly. In multiple recent reports and papers, the elderly (65 years and older) have been one group repeatedly recognized as having a heightened vulnerability to climate change (Cooper & Wadell 2010; Cutter, Emich, Webb, & Morath, 2009; IPCC, 2007; Lynn et al., 2011; Melillo et al., 2014; Morello-Frosch, Pastor, Sadd, & Shonkoff, 2009; O'Brien et al., 2008; Oxfam, 2009; Paavola & Adger, 2006). These reports regularly cite the elderly's increased likelihood, in comparison to the general population, of pre-existing medical conditions and impairments, social isolation, and financial limitations as factors contributing to their vulnerability.

Experience with previous climate related stressors demonstrates that the elderly often bear the brunt of impacts associated with extreme weather. As an example, during a 2006 heat wave in NYC, more than 80% of the deaths were among individuals ages 50 or older (Frumhoff, McCarthy, Moser, & Wubbles, 2007). Similarly, research following Hurricane Katrina found that almost 60% of flood related fatalities were among elderly residents (Jonkman, Maaskant, Boyd, & Levitan, 2009).

Researchers in a variety of fields, including emergency management, disaster risk reduction, sociology, psychology, medicine, and public health have conducted extensive studies on the vulnerability of the elderly to climate stressors (Eldar, 1992; Fernandez, Byard, Lin, Benson, & Barbera, 2002; Ngo, 2001). To summarize the current state of this understanding in the context of climate change, Gamble et al. (2013) prepared a thorough literature review drawing from peer-reviewed papers and government reports, as well as demographic and health data. Most notably, Gamble et al. grounded their summary within the context of the IPCC's three-part conceptualization of vulnerability, focusing on factors related to exposure, sensitivity, and adaptive capacity. In their summary they note the most threatening climate stressors the elderly are exposed to include heat waves, hurricanes, flooding, droughts, other forms of extreme weather, air quality, and infectious diseases. Contributing to their sensitivity, Gamble et al. highlight a number of factors associated with advancing age, including respiratory impairments, impairments associated with diabetes, cardiovascular and thermoregulatory impairments, and heat sensitivity. They also describe the importance of a variety of socioeconomic factors influencing the elderly's exposure to climate stressors. These factors include income level, access to health and social services, educational level, and adequacy of infrastructure. As determinants of adaptive capacity, the authors highlight the impacts of functional limitations, economic status, living situation, human and social capital, as well as communication technology and other community infrastructure. Their treatment of many of these factors focuses predominantly on their respective roles in limiting the adaptive capacity of the elderly in effectively responding to climate stressors (i.e. functional limitations can make it hard for elderly individuals to respond in emergency situations).

Research needs. While the review by Gamble et al. provides a valuable contribution to our understanding, scientists have, as yet, devoted little attention to conducting in-depth research on the potential vulnerability of the elderly within the context of climate change. If we are going to design and implement effective adaptation projects to enhance the resilience of the elderly, our current understanding could benefit from additional research into three key areas: the potentially novel impacts that dynamic and interacting stressors may have on the vulnerability of the elderly, adaptive resources which the elderly currently employ when dealing with climate related stressors, and the perspectives and concerns of the elderly in the context of climate change.

Our current understanding of the vulnerability of the elderly has been drawn largely from research into the elderly's historical vulnerability to climate stressors outside of the context of climate change. Gamble and her co-authors' review does begin to connect the theoretical dots by contextualizing historical research within the framework of current climate predictions, but there has been little research focused specifically on the more novel impacts of climate change. Specifically, how the predicted changes in the frequency and intensity of multiple interacting stressors may impact the elderly is largely unresearched.

In addition to exploring the multiple, compounding, and novel impacts of climate change, our understanding could also benefit from further research into factors that contribute to the elderly's adaptive capacity. While Gamble et al. devote attention to the topic of adaptive capacity and offer an important contribution, their analysis largely serves to highlight factors that limit the adaptive capacity of the elderly. To complement this understanding, it would be beneficial to further explore adaptive resources that the elderly can and do employ to prepare for, cope with, or recover from a variety of climate stressors. In his 2014 book, *Protecting Seniors Against Environmental Disasters*, disaster mitigation researcher Michael Greenberg highlights

our limited understanding of how the elderly react before, during, and after natural hazards as "the most glaring gap in our knowledge." This information could be very helpful in designing effective adaptation strategies as it would allow us to build on the elderly's existing approaches and resources.

Finally, our understanding of the vulnerability of the elderly to climate change could benefit from increased attention to the elderly's perspectives on climate change and climate stressors. Most research on elderly vulnerability views the elderly as research subjects and has focused primarily on determining possible causes of their vulnerability (Al-Rousan, Rubenstein, & Wallace, 2014; Fernandez et al., 2002; Gamble et al., 2013; Ngo, 2001). Little research has sought to incorporate the opinions or perspectives of the elderly with regards to climate change or to involve them as active participants in shaping research to ensure that it addresses their concerns. As a result of our limited understanding of the elderly's concerns and priorities relative to climate change, we risk developing adaptation strategies that do not effectively address elderly-specific needs.

In an effort to address these gaps in our current understanding, this paper presents the results of a participatory inquiry involving members of the elderly community of Bridgeport, Connecticut in examining their own vulnerability to extreme weather and the predicted impacts of climate change. This research examines the vulnerability of the elderly within the unique context of climate change, including an emphasis on adaptive strategies and resources that the elderly currently employ. In doing so, it draws directly from the experiences and perspectives of the elderly participants and seeks to share their understanding, priorities, and concerns.

Methods

This research was undertaken in partnership with the Department on Aging in Bridgeport, Connecticut in order to engage the city's elderly community in a participatory investigation into their vulnerability to climate change. The research followed the main steps employed in a vulnerability assessment, including identifying the relevant climate stressors, examining current vulnerability to those stressors, and then extrapolating future vulnerability based on predicted climate changes and potential adaptive capacity (Ford & Smit, 2004; Snover et al., 2007). We undertook a largely qualitative case study seeking to create a deeper understanding of the vulnerability of Bridgeport's elders to climate change. In particular, the research drew heavily from the principles of case study methodology, including a focus on conducting empirical inquiry into present day phenomenon within its real life context (Yin, 2009). This approach bears close resemblance to Ford and Smit's (2004) research that drew on local knowledge and experience to conduct place-specific case studies assessing the vulnerability of indigenous Arctic communities to climate change. While Ford and Smit used this approach to assess the vulnerability of entire vulnerable communities, the current research utilizes a similar approach to assess the vulnerability of a specific vulnerable group within the larger community: elderly residents within the city of Bridgeport.

The research engaged elderly participants in investigating five questions (Table 1). These questions were designed to guide participants through an iterative process of building their personal and collective understanding about the ways in which they may be impacted by climate change as well as their individual concerns in relation to climate change.

Table 1. *Five research questions.*

1. How are elderly residents of Bridgeport currently impacted by climate related stressors?
2. What factors contribute to their vulnerability to those stressors?
3. What strategies do they currently employ to prepare for, cope with, and recover from the impacts of those climate related stressors?
4. How will climate change alter their experience dealing with climate related stressors?
5. What are their most pressing concerns in relation to their vulnerability to climate change?

The city of Bridgeport is an advantageous location for this research for multiple reasons. Located in southwestern Connecticut along Long Island Sound, Bridgeport has a large and diverse elderly population with 16,000 residents, 10% of the city's population, age 65 or older encompassing a breadth of socioeconomic conditions and ethnic backgrounds (US Census Bureau, 2012) (Figure 1). Additionally, the elderly community of Bridgeport is predicted to experience multiple climatic stressors including sea level rise, increased high precipitation events, decreased air quality, and increased extreme heat in the form of heat waves and extremely hot days (Horton et al., 2014). The elderly community's previous experience with similar climate stressors, including "Super-storm" Sandy and a week-long heat wave in 2013, serve as effective precedents in assessing existing vulnerabilities and coping capacities among the elderly. In addition, the city's ongoing adaptation efforts offer the potential to integrate the findings of the project with current community-wide preparedness projects (City of Bridgeport, 2012).

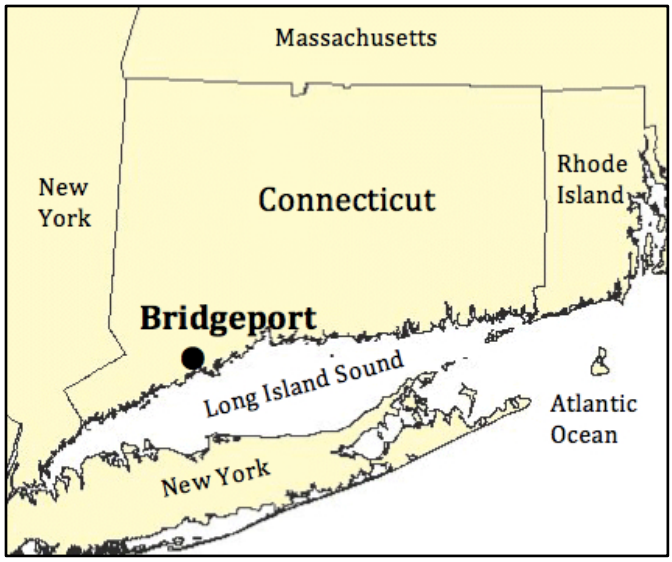

Figure 1. Map showing the location of Bridgeport, Connecticut. Base map prepared by the State of Connecticut Department of Energy and Environmental Protection (2013) and is in the public domain.

While the focus on a single community prevents this research from producing results generalizable to the broader elderly population, some of its findings may be transferable to other elderly communities. In particular, the findings may be particularly relevant in other Northeastern cities with large elderly populations exposed to similar climatic stressors (Horton et al., 2014; US Census Bureau, 2012).

To ensure that the research addressed the concerns and incorporated the perspective and experience of the elderly community of Bridgeport, the research process was guided by the principles of community-based action research (CBAR). In his 2007 edition of the book *Action Research*, prominent researcher E. T. Stringer defines CBAR as a "collaborative approach to inquiry or investigation that provides people with the means to take systematic action to resolve specific problems." In particular, the current research followed CBAR's emphasis on upholding a spirit of cooperation and equity, examining issues within their context, recognizing the validity of multiple ways of knowing, and fostering action to address issues of community concern (Strand, Cutforth, Stoecker, Marullo, & Donohue, 2003; Stringer 2007). To this end, the elderly

participants were included as voluntary partners throughout the research process, helping to determine the focus of the inquiry, contributing to the design and execution of the data collection and analysis, and reviewing and amending all of the findings.

The research was conducted in two phases. The first phase consisted of two participatory meetings focusing on the vulnerability assessment. These meetings were held at Bridgeport's main senior center, the centrally located Eisenhower Senior Center. Rather than limiting participation to invited stakeholders, the meetings were open to any elderly residents of Bridgeport who wished to attend. In order to encourage participation from a diverse representation of Bridgeport's elderly, outreach was conducted through Bridgeport's three senior centers. The three senior centers are geographically dispersed within the city and service distinct socio-economic subgroups (R. Balis, Operations Specialist with the Bridgeport Department on Aging, personal communication, July 14, 2014). The broad reach of the centers provided a vehicle to encourage a cross-section of the elderly community to participate in the research. Demographic data was collected from meeting participants via surveys to ensure that a diverse representation of the city's population was included.

Each meeting was an hour and a half in duration. During the meetings, elderly community members examined their current and potential vulnerability to climate related stressors. As the participants considered their vulnerability, they made a concerted effort to consider how their fellow community members who were not in attendance might also be affected. As such, these two initial meetings focused on the first four of the research questions (Table 1).

The first meeting began with a brief presentation about historical and predicted climate trends in Bridgeport. A summary of this information is presented in Table 2. Participants then

divided into small working groups focusing on a specific climate stressor: either extreme heat, flooding and storms, or air pollutants and allergens. Participants were free to join the group they were most interested in and there were nine working groups total, with three groups focused on each particular stressor.

Table 2. *Historical and predicted climate trends in Bridgeport.*

Stressor	**Historical trends**	**Predicted Changes**
Extreme Heat	Almost a 2 degree Fahrenheit rise in temperature over last century in the Northeast (Melillo et al., 2014)	Overall temperature increase of 3-10 ^{O}F in the Northeast by 2080 (Horton et al., 2014)
		Days over 90^{O}F expected to double in Northeastern cities by 2100 (Horton et al., 2014)
		Extreme heat amplified in urban environments like Bridgeport by heat island effect (Frumhoff et al., 2007)
Flooding and Storms	71% increase in heavy precipitation events from 1958-2012 (Melillo et al., 2014)	Heavy-precipitation events (events with more than 2 inches of rainfall in a 48 hour period) are projected to double by the end of the century in the Northeast (Walsh et al., 2014)
		Impervious surfaces in urban areas like Bridgeport increase risk of flooding (Georgakakos et al., 2014)
		Sea level is predicted to rise a minimum of 1 to 4 feet in the Northeast by 2100 (Walsh et al., 2014)
		Higher sea levels can lead to increased storm surge and associated flooding (Georgakakos et al., 2014)
		The number of days exceeding the EPA's 8-hour ozone standard will increase by 50% or more in Northeast by 2100 (Frumhoff et al., 2007)
Air Pollution and Allergens	Tropospheric ozone and fine particulate matter are positively correlated with temperature (Luber et al., 2014)	Warmer temperatures will accelerate ozone forming chemical reactions in the atmosphere (Luber et al., 2014)
		Predicted increases in the frequency and duration of periods of air stagnation will allow pollution to accumulate in certain areas (Luber et al., 2014)
		Longer growing season and warmer weather in the Northeast will promote greater plant emissions of allergens and natural ozone precursors (Frumhoff et al., 2007; Luber et al., 2014).

Each group utilized antecedent and consequence mapping to develop a picture of their vulnerability to current and predicted climate stressors. Antecedent and consequence mapping is a collaborative approach to inquiry that allows a group to explore and map out possible cause and effect relationships at play in an issue of concern to them (Stringer, 2007). In an effort to answer the first research question, each working group began by discussing how they were currently impacted by the given climate stressor. Then, focusing on the second research question, they discussed factors that contributed to their vulnerability to the given stressor. Finally, exploring the third research question, participants focused on how they prepare for, cope with, or recover from the given stressor. These discussions were self-facilitated by the elderly groups, although the lead researcher and staff from the Department on Aging did check in with each group to provide guidance as needed. Each group recorded their discussions on flip chart paper. To encourage a diversity of perspectives, the groups recorded individual observations as well as observations held in common. At the conclusion of the meeting, each working group shared the results of their discussions with the other participants and members of other groups offered additional suggestions.

A summary document of the discussions was shared with participants at the second meeting. Participants offered additional feedback, which was incorporated into the current findings. Then, to answer the fourth research question, participants reviewed recent climate predictions for the Bridgeport area and discussed how their vulnerability to each stressor might change in the coming years. The compiled results of this discussion were reviewed by the participants and their feedback was incorporated into the current findings.

For the second phase of the research, which focused on the fifth and final research question, the elderly participants collaborated with the lead researcher to develop a Likert scale

survey to allow a broad range of elderly community members to rank their personal level of concern over various factors contributing to their vulnerability. These factors were based on the discussions during the vulnerability assessment meetings and were supplemented by additional questions based on important findings in the scientific literature. The Likert scale had five points ranging from "unconcerned" to "very concerned." In order to reach a diverse representation of Bridgeport's elderly, including high need segments of the population, participants recommended that we distribute both English and Spanish language versions of the survey. Both versions were distributed by a number of local organizations suggested by the participants including the Bridgeport Department on Aging's three senior centers, CW Resources' Meals on Wheels Program, St Vincent's Medical Center, the Bridgeport YMCA, the Stratford Visiting Nurses Association, and local houses of worship.

Demographic data was collected from a random subset of one in five survey respondents to ensure that surveys were reaching a diverse representation of Bridgeport's elderly population. Survey results were analyzed to note respondent's average level of concern over each factor. In addition, to ensure that any concerns specific to minority sub-groups within the elderly population were represented in the final results, the number of highly concerned responses (responses of a four or five) were also totaled for each question.

Results and Discussion

Meeting participation. A total of 55 elderly residents of Bridgeport participated in the two vulnerability assessment meetings. They comprised a diverse representation of Bridgeport's elderly community (Table 3). Furthermore, as the participants considered their vulnerability to

climate change, they made a concerted effort to consider how their fellow community members who were not in attendance might also be affected.

Table 3. *Demographic comparison of vulnerability assessment meeting participants with general elderly population of Bridgeport.*

Category	**Meeting participants**	**Elderly population in Bridgeport (*n=55*)**
Age (Average)	73.8	74.2
Age by Cohort (%)		
65-74	60	n/a
75-84	24	n/a
85+	16	n/a
Gender (%)		
Female	78.1	60.8
Male	11.9	39.2
Race (%)		
Asian	1.8	2.8
Black or African American	61.8	28.3
White	25.5	63.3
Other	10.9	5.6
Hispanic or Latino (%)	16.7	22.1
Living Alone (%)	49	59.9
Educational Attainment (%)		
Less than a High School degree	37.7	41.3
High School degree or equivalent	41.5	34.1
Some college/associates degree	15.1	14.6
Bachelors degree or higher	5.6	10.1
Living With a Disability (%)	56.6	41
Primary language (%)		
English	84.6	n/a
Spanish	9.1	n/a
Greek	1.8	n/a
Portuguese	3.6	n/a
Chinese	1.8	n/a
Speak English less than very well (%)	10.9	29
Employment (%)		
Full or part time	13.5	15.9
Unemployed or retired	86.5	84.1

Household income (%)		
Less than $10,000	58.7	n/a
$10,000-$20,000	26.1	n/a
$20,000-$40,000	13	n/a
$40,000+	4.3	n/a
Housing status (%)		
Owner occupied	40	55.6
Renter occupied	60	44.4

Note: Data for the general elderly population in Bridgeport is taken from the US Census Bureau's American Community Survey (2012).

Current impacts. Participants described multiple ways in which they and their fellow elderly community members are currently impacted by extreme heat, air pollution, and flooding and storms (Table 4). These impacts included personal injury, illness, trauma, as well as damage to property. Impacts ranged from short term to long term. The impacts can be most easily grouped into those resulting from extreme heat and air pollution, and those resulting from flooding and storms.

Table 4. *Current impacts of climate related stressors on the elderly population of Bridgeport as identified by participants.*

Climate Related Stressors	**Current Impacts**
Extreme heat and air pollution	General pain and discomfort including difficulty breathing and difficulty sleeping
	Mental upset including anxiety, depression, irritability
	Illness and hospitalization
	Isolation
	Difficulty doing essential tasks
Flooding and Storms	Property damage
	Loss of electricity leading to difficulties cooking, heating, running medical equipment, or leaving apartment, also leading to loss of refrigeration and spoilage of food and medicines (i.e. insulin)
	Physical injury
	Illness and hospitalization
	Difficulty doing essential tasks
	Caregivers unable to access patients

Current impacts of extreme heat and air pollution. As a result of extreme heat and elevated air pollution, participants noted a variety of physical ailments including general pain and discomfort as well as difficulty breathing and difficulty sleeping. Participants also experienced a variety of psychological impacts including anxiety, depression, and irritability. In more severe cases, participants described illness and hospitalization following extreme heat and high levels of air pollution. Participants also explained how these events can serve to trap elders in their homes, leading to isolation and difficulty accessing needed resources or services, including groceries, medicine, or medical treatments. As one participant stated, "If it gets too hot, I just have to stay inside my house and can't go out."

Current impacts of flooding and storms. Participants noted that storms and flooding could lead to physical injury that can be followed by a prolonged and difficult recovery process. Additionally, if electricity goes out as a result of a storm, elders could be unable to run needed medical equipment, heat their home, cook, or refrigerate their food. Loss of electricity could also result in the spoilage of medication, such as insulin, that requires refrigeration. Elders dependent on an elevator or stair lift could become trapped in their home. Participants also noted challenges coping with trauma and stress following storms and flooding. Elders noted challenges travelling to get medications and medical treatments, as well as running errands during or following a storm. They also explained that storms and flooding can make it difficult for caregivers to access elders during and following storms or flooding. Additionally, participants described multiple ways that storms and flooding can result in damage to their property, with floods filling basements with water, high winds damaging roofing or siding and bringing down limbs on their yard or house. They explained how some of these impacts can in

turn have health impacts. For example, sewage overflow and mold contamination following flooding can make elders' homes unsafe and result in illness if left untreated.

Current vulnerability. Participants identified a number of personal characteristics and contextual factors that contribute to their current vulnerability to these stressors and the severity of their experience of these impacts. In this effort, participants drew on their own experience and that of their fellow elders and considered factors that either increased their sensitivity or reduced their adaptive capacity. The participant's descriptions largely echo the findings from other studies on the vulnerability of the elderly to climate stressors (for comparison see Eldar, 1992; Fernandez et al., 2002; Gamble et al., 2013; and Ngo, 2001).

Personal characteristics. Participants noted a variety of personal characteristics ranging from health to socioeconomic conditions that contributed to their vulnerability to climate change (Table 5). Some characteristics contributed to vulnerability by increasing sensitivity, while others contributed by reducing adaptive capacity.

Table 5. *Personal characteristics contributing to the vulnerability of elderly individuals in Bridgeport to climate related stressors as identified by participants.*

Personal Characteristics	**Contributing factors/examples**
Chronic health conditions	Diabetes
	COPD
	Asthma
	Lung infections
Physical/cognitive impairments, disabilities	Alzheimer's
	Confinement to a wheelchair
	Poor hearing/vision
Social Isolation	Difficulty traveling
	Diminished social circle
	Living alone
Economic limitations	Retired or working part time with low/fixed income
	Minimal savings
	Poor credit

Marginalization	Poor English speaking ability
	Minority status
	Low educational attainment
	Low income levels

Chronic health conditions. Participants highlighted certain chronic health conditions prevalent among the elderly that can increase their sensitivity to climate change by causing adverse reactions to certain climate stressors. In particular, participants noted adverse reactions to high temperatures worsened by diabetes. Participants described how conditions including asthma, lung infection, and chronic obstructive pulmonary disease (COPD) can lead to more severe reactions to air pollution.

Physical/cognitive impairments and disabilities. Living with a disability, a condition facing 41% of Bridgeport's elders, was noted as an important factor potentially reducing their adaptive capacity (US Census Bureau, 2012). As an example, participants described how, for individuals confined to a wheelchair, traveling to a cooling center or shelter in a heat wave or storm can be extremely difficult. They noted how challenges with traveling can be exacerbated in emergency situations.

Participants described how Alzheimer's and other cognitive impairments can present challenges throughout the hazard life cycle, making it difficult for elders to receive and comprehend warnings, take needed steps to protect themselves, and navigate potentially complex recovery processes. They highlighted that poor hearing can make it difficult for the elderly to hear or fully comprehend warnings associated with extreme weather and climate related stressors. They described how impairments and diseases can make elderly individuals dependent on the support of caregivers, leaving them at heightened risk during events like storms or flooding that can prevent caregivers from gaining access to them.

Social isolation. As of 2012, 59.9% of elderly residents in Bridgeport lived alone (US Census Bureau, 2012). Participants highlighted living by oneself as an important factor that contributes to the vulnerability of some elderly individuals. They suggested that elderly individuals living alone might be less likely to receive important information regarding climate related stressors such as warnings or instructions. Isolated elders with a limited ability to use modern communication technology could be at even greater risk of failing to receive warnings. Participants also noted how isolated elderly individuals may lack the social support network to help them respond effectively to emergency situations. Participants voiced concern that these elders may not have the support needed to recover from illness, injury, or property damage resulting from climate related stressors and may not have the social support to assist in coping with associated mental trauma or stress. As one participant commented, "If there is a big storm, I don't have any living relatives to come check on me and see if I need help."

Economic limitations. As of 2012, 84.1% of Bridgeport's elderly residents were unemployed or retired and 17.3% of Bridgeport's elderly residents lived below the poverty line (US Census Bureau, 2012). Participants identified a number of ways that lack of employment and living on a low or fixed income can reduce adaptive capacity by preventing elderly individuals from taking steps to prepare for, cope with, or recover from climate stressors. Elders may lack the money needed to make preparations to a residence so that it will be storm-safe, to find safe shelter in an emergency, or to conduct needed repairs or clean up after a storm or flood. In the context of extreme heat and air pollution, financial limitations can prevent elderly individuals from purchasing and running air conditioning or dehumidifiers. Economic limitations can also make receiving needed medical treatment or medication following an injury or illness more challenging.

Marginalization. In discussing the elderly, researchers typically note a variety of factors that can serve to marginalize individuals or groups thereby increasing their vulnerability to climate stressors. These include minority status, little formal education, and low-income levels (Gamble et al., 2013). Given the significant percentages of Bridgeport's elders with these demographic characteristics (Table 1), it seems likely that marginalization contributes to the vulnerability of a substantial fraction of the elderly population in Bridgeport. In addition to highlighting the challenges associated with low income discussed above, participants observed that individuals with a limited command of the English language can face difficulties receiving warnings of impending severe weather, taking steps to protect themselves, and receiving needed support as part of the recovery process. While other factors, including minority status and educational attainment, were not discussed in-depth by the group, participants did note that such characteristics could pose additional challenges.

Contextual factors. In addition to personal characteristics, participants highlighted four contextual factors that can serve to enhance or limit the adaptive capacity of the elderly. In contrast to the previous characteristics, which were largely attributable to individuals, these contextual factors are rooted in the communities in which individuals reside and are associated with various initiatives and institutions promoting safety and well-being among the elderly community. These contextual factors are: adequacy of transportation resources, effectiveness of public warning mechanisms, availability of resources to promote safe shelter, and adequacy of resources to aid in coping and recovery (Table 6).

Table 6. *Contextual factors influencing the vulnerability of elderly individuals in Bridgeport to climate related stressors as identified by participants.*

Contextual Factors	**Associated Challenges**
Adequacy of transportation resources	Don't own a car
	Difficulty driving
	Inadequate public transportation
	Needing special accommodations
	Lacking money to pay for transportation
	Unaware of available resources
Effectiveness of warning mechanisms	Lack of technological fluency
	Isolation
	Poor English speaking ability
	Warnings difficult to understand
Availability of resources to promote safe shelter	Lack of money to pay for air conditioning or dehumidifiers
	Unable to conduct needed home repairs
	Lack of money to pay for emergency housing
	Insufficient shelters or cooling centers
	Difficulty accessing shelters of cooling centers
	Unaware of available resources
Adequacy of resources to aid in coping and recovery	Lack of mental health resources
	Difficulty accessing medical resources
	Difficulty performing essential activities
	Difficulty repairing damages to property
	Unaware of available resources

Adequacy of transportation resources. Participants noted that adequate transportation resources are vital for elderly individuals to gather resources needed to prepare for climate related stressors, to seek safe shelter away from home if needed, and to access needed resources and services to aid in their recovery. Many of the personal characteristics described above, including certain disabilities, diminished sensory awareness, and financial limitations, can make it difficult for elderly individuals to drive or own a car. As a result, many elderly are highly dependent on public transportation for meeting these needs. Even for individuals who can normally drive a car, inclement weather and potential flooding during severe storms may make

them unable to drive or uncomfortable doing so, causing them to seek alternative transportation. As a result, participants shared that their vulnerability to climate related stressors depended in part on the availability of transportation options to bring them from their home to grocery stores, shelters, cooling centers, clinics, and hospitals. Given the limited financial resources of many elders, participants noted that these options have to be very inexpensive. They highlighted that transportation options need to be able to accommodate and support individuals with a variety of disabilities as well as people who may need to bring specialized medical equipment or supplies with them. Finally, they highlighted that elders also need to be aware of transportation resources and how they can access them.

Effectiveness of warning mechanisms. In addition to the importance of transportation resources, participants noted it is important for elders to receive adequate warning of upcoming climate related stressors so that they can take steps to protect themselves. Again, personal characteristics, including social isolation, cognitive impairments, diminished sensory awareness, and a lack of technological fluency, can make it difficult for governments or other support organizations to provide elders with adequate warning. It is even more difficult to reach elders with limited English speaking ability. To overcome these challenges, participants noted that it is important for warnings to be distributed using appropriate technology to reach elderly populations, with information relevant to the elderly and their needs, and be communicated clearly in a manner that will be understandable to elders with a variety of cognitive and sensory capacities. Considering appropriate technology for distributing warnings, participants suggested that they preferred to be contacted by telephone or in person. This latter approach suggests a need to mobilize community organizations in reaching out to elderly individuals to make sure they are aware of and prepared for upcoming climate related stressors.

Availability of resources to promote safe shelter. Participants noted the importance of having access to safe shelter during extreme weather or other climate related hazards. Elders explained that this could include making their home safe from climate related stressors, either through home repairs to weather storms, or through purchasing and running air conditioning in a heat wave or period of elevated air pollution. Financial limitations can make this challenging for many elders and can also prohibit them from being able to pay for alternate shelter in an emergency. As a result, participants highlighted the importance of having emergency shelters and cooling centers available. They also noted that shelters need to be able to accommodate elders with special needs and that elders need to be aware of the location of shelters. This is not always the case, as one participant commented, "I have no idea where they are or what to bring." Additionally, participants highlighted the importance of having adequate transportation resources to bring elders to shelters or cooling centers.

Adequacy of resources to aid in coping and recovery. Given the potential for climate related stressors to result in physical injury, trauma, stress, illness, or property damage, the participating elders noted the importance of resources to aid them in coping and recovery. They described how financial limitations, disabilities, and chronic medical conditions can make it difficult for seniors to travel to or afford needed medical treatments or medications. Elderly with these conditions could have difficulty accomplishing essential tasks during or following a climate related stressor. These conditions can make it difficult for elderly individuals to personally undertake or pay for home repairs or clean up after storms. Elders highlighted the importance of support in these diverse aspects of the recovery process. As with the other factors, they noted that elders need to be aware of these resources and accessing them needs to be simple enough for them to navigate.

Current adaptive strategies and resources. Against this backdrop, participants shared a number of adaptive strategies and resources that they currently employ to prepare for, cope with, and recover from extreme weather and other climate related stressors (Table 7).

Table 7. *Current adaptive strategies utilized by elderly individuals in Bridgeport to prepare for, cope with, or recover from climate related stressors as identified by participants.*

Climate Related Stressors	Current Strategies	Secondary Impacts/Limitations
Extreme heat and air pollution	Stay inside	Leads to increased isolation and difficulty doing essential tasks
	Close windows and run AC/dehumidifier	Leads to increased electricity costs
	Travel to hospital	Costs money and time, causes mental and physical fatigue
Flooding and Storms	Stay in a hotel	Costs money
	Stay with family or friends	Only possible for elderly with family or friends nearby
	Pay for clean up/repair work	Costs money

Current adaptations to extreme heat and air pollution. Participants noted a number of adaptive strategies they employ in the contexts of extreme heat and air pollution. They explained how they often remain indoors at home during times of extreme heat or poor air quality, but noted how this can lead to ongoing isolation and prohibit elderly individuals from running important errands to obtain medical treatments and groceries. Some participants described closing their windows and running air conditioning, but they added this presents an additional expense that many elders cannot afford, especially as energy costs have been steadily rising. One participant compellingly explained, "It sets a double standard, where those who can afford it can protect themselves, but those who can't, especially those living alone and on a fixed income, are more at risk." During periods of extreme heat, participants highlighted a number of additional ways that they modify their behavior, including dressing light, drinking extra fluids, taking cool showers, closing the blinds, and eating light foods. In the context of air pollution,

some participants also noted that they have to use breathing machines, which makes it difficult for them to travel and run errands. Finally, as a result of extreme heat and air pollution, participants explained that they sometimes need to travel to the hospital for treatments. When this occurs, participants described that it can be difficult for them to travel and also can be financially burdensome and overly time consuming.

Current adaptations to flooding and storms. Some elders mentioned needing to seek shelter in a hotel during storms if they felt their home was or might become unsafe. They also noted that this was an expensive option that was challenging or unavailable for many elders given their limited economic resources. Some participants also described how they would go to stay with friends and family during or following a storm if their home might be unsafe or was damaged. Again, participants explained that this would not be an option for isolated elders lacking a local social support network. Finally, following floods and storms, participants described how they were often incapable of undertaking the needed cleanup or repairs to their property and, as a result, have had to pay someone for those services. Participants highlighted the challenges of paying for this added expense.

Potential impacts of predicted climate changes on elderly vulnerability.

Participants described two primary ways in which their vulnerability may be impacted by predicted changes in extreme heat, flooding and storms, and air pollution and allergens. First, previously unaffected or little affected elders may be underprepared to cope with increasing impacts if climate related stressors intensify. Second, increasing intensity of these climate stressors coupled with an increase in the frequency of their occurrence could overwhelm the adaptive capacity of some elderly individuals.

Currently, some elderly individuals may be largely unaffected by various climate related stressors. As climate change progresses, however, these individuals may begin to be adversely impacted and they could find themselves unprepared and without any previous coping experience. The lack of preparedness and coping strategies could heighten the vulnerability of those elderly. For example, an elderly individual's basement may have never experienced flooding during the decades they have lived there, but increases in heavy precipitation events could result in severe flooding causing damage to the residence. As another example, an elderly individual who has been previously unaffected by high temperature days may find herself experiencing heat related illnesses as the intensity of heat waves increases. In both cases, the individuals could lack important information or strategies and, as a result, could face significant challenges coping with and recovering from these novel impacts.

Even elderly individuals who have been previously impacted by certain climate related stressors may find their previous adaptive strategies insufficient to protect themselves from predicted changes. Participants suggested that even small changes in the intensity of climate related stressors can have a significant impact on some elders. As one elder shared, "Even a difference of a couple degrees in temperature can be a big deal to me."

Participants noted that, in both of these cases, the risk to elders could be increased if they underestimate the severity of future extreme weather events. They suggested that elderly individuals may base their decision making about how to prepare for future events on their past experience with similar events. While this approach might have served them reasonably well in the past, if certain climate stressors increase in intensity, it could result in elders underpreparing for more severe events, thereby putting themselves more at risk.

Even if elders perceived the risks they face as severe and wished to protect themselves from those risks, climate change could fundamentally overwhelm their adaptive capacity. As participants described, the adaptive capacity of many elders can be severely limited by numerous factors including a lack of financial resources, social isolation, health conditions and disabilities, and marginalization (Table 5). As was illustrated in the descriptions of various adaptive strategies that the elderly currently employ, many of their current approaches can have secondary impacts that can serve to further draw down their existing adaptive capacity (Table 7). If elders are forced to employ these adaptive strategies to a greater degree, the secondary impacts could exhaust their economic, physical, mental, and social resources. This is exemplified by one participant's concern, "Sure I could run my AC more, but that costs more money that I don't have, so where am I going to get the money from?" Additionally, climate stressors will not be changing in isolation, but predictions contend that extreme heat, flooding and storms, and air pollution will all increase in concert. Even if individuals were able to muster the resources to safeguard themselves from increases in one stressor, concurrent increases in other stressors may prove overwhelming. For example, even if the previously quoted participant could find the financial resources to run the additional air conditioning required to cope with increasing heat waves, concurrent increases in home repair costs from more severe storms may be more than she could afford.

Prioritizing the elderly community's concerns over climate change. These potential impacts highlight the vitally important role that contextual factors, such as effectiveness of warning mechanisms and the availability of resources to promote safe shelter, play in protecting the elderly from the impacts of climate change. In order to design adaptation measures that

effectively address the needs of the elderly community, it is important to understand which of these contextual factors they are most concerned about.

The Likert scale survey developed by the elderly participants and researchers was designed to allow the broader elderly community of Bridgeport to voice their concerns and help inform local adaptation efforts. A total of 164 elders completed the survey. While the survey was not a random sample, and so can not be generalized to the larger elderly population of Bridgeport, demographic data collected from a random subset of one in five respondents demonstrates that the survey reached a diverse representation of Bridgeport's elderly community (Table 8). The demographic data also shows that the survey reached segments of the elderly population with characteristics such as living alone or living on a low income, that may put them at heightened risk to climate related stressors and who are therefore in greatest need of assistance.

Table 8. *Demographic comparison of survey respondents with general elderly population of Bridgeport.*

Category	**Survey respondents**	**Elderly population in Bridgeport (*n=35)***
Age (Average)	75.3	74.2
Age by Cohort (%)		
65-74	51.4	n/a
75-84	25.7	n/a
85+	22.9	n/a
Gender (%)		
Female	77.1	60.8
Male	22.9	39.2
Race (%)		
Asian	2.9	2.8
Black or African American	54.3	28.3
White	28.6	63.3
Other	14.3	5.6
Hispanic or Latino (%)	23.5	22.1
Living Alone (%)	51.4	59.9

Educational Attainment (%)		
Less than a High School degree	42.9	41.3
High School degree or equivalent	37.1	34.1
Some college/associates degree	11.4	14.6
Bachelors degree or higher	8.6	10.1
Living With a Disability (%)	52.9	41
Primary language (%)		
English	77.1	n/a
Spanish	14.3	n/a
Chinese	2.9	n/a
Croatian	2.9	n/a
Hungarian	2.9	n/a
Speak English less than very well (%)	17.1	29
Employment (%)		
Full or part time	14.3	15.9
Unemployed or retired	85.7	84.1
Household income (%)		
Less than $10,000	55.2	n/a
$10,000-$20,000	17.2	n/a
$20,000-$40,000	20.7	n/a
$40,000+	6.9	n/a
Housing status (%)		
Owner occupied	63.3	55.6
Renter occupied	36.7	44.4

Note: Data for the general elderly population in Bridgeport is taken from the US Census Bureau's American Community Survey (2012).

The survey results highlight the respondents' generally high level of concern over climate related stressors (Table 9). Respondents ranked 14 of the 40 questions as an average of three or above and more than 30% of respondents ranked 23 of the 40 questions as high concerns (four or five on the Likert scale). A number of participants' most pressing concerns focused on receiving adequate warning. Specifically, this included concerns over not receiving warnings or of receiving warnings that do not have enough information or are hard to understand. Participants also expressed higher levels of concern over factors related to shelter, including concerns over the safety of their homes, difficulties getting to shelter locations, the safety and comfort of

shelter locations, as well as their abundance. Additionally, participants ranked certain issues related to getting assistance and the recovery process as particularly concerning. These included concerns over travelling to the hospital both during and following climate related stressors, getting food and supplies, doing essential activities while electricity is out, coping with trauma and stress, and conducting repairs and clean up on their property following a storm or flood.

Table 9. *Survey results showing respondents average level of concern over various issues associated with extreme weather and percentage of respondents ranking each issue as a high concern. (n=164).*

Receiving Adequate Warning	**Average Level of Concern**	**% Highly Concerned**
Won't receive warning	3.58	50%
Warning won't have enough info	3.74	62%
Warning will be hard to understand	3.48	51%
Warning won't be in my language	1.97	18%
Staying Safe at Home		
My house is unsafe and can't afford to fix	3.29	47%
Can't afford to run AC in heat wave	2.76	36%
Can't afford to run AC in air pollution	2.67	35%
Having Adequate Transportation Resources		
Lack of public transportation where I live	2.49	29%
Lack of ride sharing where I live	2.89	39%
Public transport is too expensive	2.46	26%
Can't afford transportation in emergency	2.54	27%
It is physically difficult for me to travel	2.29	19%
It is hard to travel because of equip needs or medicine	2.07	16%
Finding Safe Shelter		
Don't know where shelter is located	2.92	39%
Hard for me to get to shelter	3.01	46%
Shelters are unsafe	3.14	44%
Shelters are uncomfortable	3.08	40%
There are not enough shelters	3.45	57%
Hard for me to stay in shelter because of equip needs or medicine	2.48	28%
Getting Needed Assistance		
No one will check on me during or after extreme weather	2.90	30%
Don't know emergency numbers	2.86	38%

Won't be able to leave my building if power is out	2.19	19%
Will be difficult for caregivers to reach me in storm	2.65	32%
Will be difficult to get to hospital or get medicine during or after extreme weather	3.08	43%
Will be difficult to get food and supplies during or after extreme weather	3.25	47%
If electricity is out, will be difficult to do essential activities	3.45	51%
Having Resource to Aid in Recovery		
Difficult to cope with trauma and stress	3.05	36%
Difficult to travel to hospital for treatment if injured or sickened	3.27	47%
Difficult to afford medication or treatment if injured or sickened	2.93	34%
Won't have needed support to do daily tasks if injured or sickened	2.94	32%
Difficult to do clean up or repairs to property	3.19	47%

Note: For Likert scale, 1=unconcerned and 5=very concerned. For % highly concerned, a ranking of a 4 or 5 is considered a high level of concern.

While it is important to note the most prominent concerns of the respondents, it is also important to pay attention to concerns that might be held by specific sub-groups within the elderly community. As the meeting participants discussed, vulnerability is made up of multiple personal characteristics and contextual factors. The composition and impact of these factors vary greatly among elderly individuals. As a result, certain sub-groups within the community many have specific needs or concerns based on unique aspects of their vulnerability. For example, concerns over not receiving warnings in a language you understand will only affect elderly individuals who do not speak English or who speak it poorly. While this sub-group only represents 29% of the city's total elderly population, and so their concern will not be shared generally, it is an important factor contributing to the vulnerability of those individuals. This relatively low level of overall concern but high level of concern for a specific sub-group is seen

in the survey results, with concern over warnings not being in an individual's language ranking a 1.97 overall, but with 18% of respondents ranking this as a high concern. While this is not a commonly shared concern in the community, it is an important concern for those 18% of the respondents. Their concern deserves due consideration by government agencies, non-profits and other support organizations. Such a perspective presents the survey results in an additional light, as all 40 questions were ranked as high concerns by over 15% of respondents. From this perspective, all of the issues presented in the survey represent important concerns to over 15% of the respondents and as such merit further attention and effort to find opportunities to support elders with those concerns.

It is interesting to note that in a follow up conversation with city staff from the Office of Emergency Management and Homeland Security, they explained that there are current programs to address many of the concerns expressed by elders in the survey, but that elderly individuals were often unaware of them or how to utilize them. Prominent examples of existing programs include a reverse 911 service that can call elders on their home phone with emergency warnings and the Hope Dispensary program designed to assist elders with filling their prescriptions during an emergency. In this context, the vulnerability of some elderly in Bridgeport may not be due primarily to a lack of programs, but to poor awareness of available resources and a lack of emergency preparedness. This echoes the findings of a recent survey conducted by Al-Rousan et al. (2014) investigating the elderly's preparedness for natural disasters. Sampling elderly individuals across the United States, this study found that two-thirds of the elderly did not have an emergency preparedness plan and were largely unaware of emergency resources and information. Furthermore, one-third did not have basic food, water, and medical supplies in case of an emergency. These observations support the assertion by Gamble et al. (2013) that

education and outreach should be two important aspects of adaptation efforts targeted at elderly populations. Within this context, an important question for the city of Bridgeport and potentially for other locations will be not only how to develop additional programs to protect the elderly, but how to conduct the outreach and education efforts to make them more aware of existing resources and to enhance preparedness.

Conclusion

This case study of the elderly community of Bridgeport, Connecticut provides an example of the numerous and potentially serious ways in which elders are impacted by climate related stressors including extreme heat, air pollution, and flooding and storms. It demonstrates how multiple personal characteristics associated with advancing age serve to increase their vulnerability. It also shows how even relatively minor impacts that are often overlooked in the broader literature on disasters and the elderly can present significant challenges to some elderly individuals. For example, a downed limb in an elderly individual's yard following a storm could cause stress, physical injury, or financial hardship.

Additionally, we can see how a variety of personal characteristics, including financial limitations, social isolation, and cognitive and physical impairments, serve to limit the adaptive capacity of many elderly individuals. The predicted impacts of climate change, including potentially rising temperatures, increased high precipitation events, and increased air pollution, could easily overwhelm some elders' limited capacity to adapt. For this reason, contextual factors, including the effectiveness of warning mechanisms, adequacy of public transportation, availability resources to promote safe shelter, and adequacy of resources to aid in coping and recovery will be vital in keeping the elderly community safe.

As the city of Bridgeport prepares for climate change and continues their work to safeguard their residents, it will be vital to ensure that these contextual factors provide the resources that their elderly citizens will need. To aid in this effort, it is important to have a picture of the elderly community's vulnerability to climate change. To ensure that this picture accurately reflects the lived experience of the elderly and captures their needs and concerns, it is important to directly involve the elderly participants in the planning process. As we can see in this case study in Bridgeport, elders are concerned about a variety of issues ranging from inadequate public warnings to a lack of public transportation options. To effectively respond to these concerns, adaptation strategies will need to be developed to address a diverse set of needs. Many programs are already in place, but some may need to be tailored to better meet elders' needs. Additionally, outreach and education targeted at the elderly community may be required to encourage preparedness and ensure that elders are aware of the available resources and how to utilize them. In other cases, it may be necessary to develop new program to meet certain needs.

While this study is limited to one location, aspects of this elderly community's vulnerability to climate change may be applicable in other locations, especially other Northeastern cities facing similar climate stressors and with similar socioeconomic characteristics among the elderly population. Some specific findings of this study may vary substantially from one area to the next, however, other findings may prove more fundamental. Given the multiple characteristics associated with aging that can serve to increase sensitivity and reduce adaptive capacity, it is possible that in other locations, contextual factors will also play an important role safeguarding elders from the impacts of climate change. Given the diverse socioeconomic and health characteristics that influence the vulnerability of the elderly population generally, it is possible that, similar to Bridgeport's elderly community, other

communities might also hold a broad range of concerns regarding their vulnerability to climate change.

Further studies in additional communities are needed to determine the degree of variability from site to site and which facets of this study are transferable under different circumstances. This additional research could aid in developing nuanced vulnerability indicators capable of mapping the vulnerability of elderly communities to climate change. While this would fill a key gap highlighted by Gamble et al. (2013) in our ability to keep the elderly safe, it is also important that such indicator-based assessments do not preclude participatory processes that give voice to the local concerns of any given elderly community.

It is also important to note that this study focused on the vulnerability of elderly individuals living independently. Elders living in managed care facilities will likely have a very different experience of climate related stressors and the nature of their vulnerability could be quite dissimilar. Further research is needed to investigate the vulnerability of the elderly within this context.

By conducting additional research exploring the potential impacts of climate change on the elderly, especially research that integrates the elderly community as participants, we can develop detailed understandings of the factors that increase or reduce their vulnerability in different contexts. We can also better understand their concerns. These understandings provide an important basis for adaptation planning that, in turn, can bring elderly communities together with local governments and a broad coalition of partners to help keep the elderly safe in a time of climate change.

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Preface to Chapter 5

Chapter Five is written in journal article format. It presents the continuation of the adaptation planning process discussed in Chapter Four. Specifically, Chapter Five describes the results of the two adaptation planning meetings that built on the outcomes of the vulnerability assessment presented in Chapter Four. In addition, Chapter Five describes the aspects of the summative evaluation that focused on the project outcomes in term of enhancing the resilience of the elderly. Chapter Five addresses the following primary research questions:

- What are the elderly community of Bridgeport's preferred strategies for enhancing their resilience to climate change?
- Can a participatory adaptation planning process enhance the resilience of the elderly in Bridgeport and, if so, in what ways?

Chapter Five begins with an introduction that revisits the disproportionate challenges climate change will pose for the elderly. It also highlights the need for and difficulties associated with designing adaptation strategies to enhance the resilience of the elderly. The methods section begins by briefly reviewing the research presented in Chapter Four. It then describes the research process associated with the two adaptation planning meetings and the summative evaluation that investigated the project's ability to enhance the resilience of the elderly in Bridgeport. The results and discussion section presents the outcomes of the two meetings, including the adaptation goals and recommendations developed by the elderly participants. The analysis of the summative evaluation is also presented.

Chapter 5: Using Participatory Climate Change Adaptation Planning to Promote Resilience Among the Elderly

Abstract

Compared to the general population, the elderly are predicted to bear a disproportionate burden of the impacts of climate change. As a result, it is important to develop adaptation strategies that address the unique causes of their vulnerability. Their first-hand knowledge, not only of their vulnerability, but also of potential measures to protect them could be useful in developing these strategies. Unfortunately, there is little research investigating their preferred adaptation strategies and community-wide planning might fail to capture their unique perspectives and concerns. To provide insight into the preferred adaptation strategies of the elderly, this paper presents the results of a participatory adaptation planning process involving the elderly community of Bridgeport, Connecticut. Based on a community generated understanding of their vulnerability, the elderly participants followed adaptation planning best practices to develop a series of overarching adaptation goals and specific recommendations. With an aim at inclusively addressing a broad range of concerns, participants' goals focused on encouraging preparedness and providing community services including warning mechanisms, resources to secure safe shelter, transportation resources, resources to provide essential care during climate related emergencies, and resources to aid in the recovery process following such an event. Based on these goals, participants recommended the following actions:

1. Provide emergency preparedness trainings specifically for seniors.
2. Develop and distribute emergency preparedness informational materials specifically for seniors.
3. Conduct a reverse 911 sign up drive targeted at seniors.
4. Tailor warnings to meet seniors' needs.
5. Tailor shelters to meet seniors' needs.
6. Promote volunteer ridesharing and transportation assistance.

7. Establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors.

A prioritization process shows the participants believed all of the suggestions were likely to be both effective and feasible to implement. In addition to developing potentially effective adaptation strategies, a summative evaluation shows the participatory planning process enhanced resilience by raising awareness and understanding among the elderly participants and city agencies, enhancing communication among relevant organizations, and increasing the elderly participants' ability to self-advocate.

Introduction

The elderly, also referred to as seniors and comprising individuals age 65 or older, have been highlighted as one group with a heightened vulnerability to climate change (Gamble et al., 2013). Past experience has shown that the elderly are disproportionately impacted by a variety of climate related stressors predicted to worsen with climate change (Frumhoff, McCarthy, Moser, & Wuebbles, 2007; Gamble et al., 2013). These include storms, flooding, droughts, extreme heat, and air pollution. For example, during a 1995 heat wave in Chicago, 72% of deaths were among individuals over 65 year of age, a mortality rate 14.6 times higher than the general population (Whitman et al., 1997). In addition to loss of life, the elderly are also at high risk to suffer injury or illness, mental trauma and stress, financial losses, and damage to personal property as a result of climate related stressors (Eldar, 1992; Fernandez, Byard, Lin, Benson, & Barbera, 2002; Ngo, 2001).

Research in fields including disaster management and public health has found a number of characteristics associated with advancing age that can contribute to the elderly's risk of harm from climate related stressors (Gamble et al., 2013). These characteristics include chronic health

conditions, physical and mental impairments, financial limitations and social isolation (Eldar 1992; Fernandez et al. 2002; Ngo 2001; Pietschmann, Rauner, Sipos, & Kerschan-Schindt, 2009) These characteristics will put the elderly at even greater risk if certain climate stressors increase in severity as predicted in recent climate models (Gamble et al., 2013; Horton et al., 2014). These characteristics will also likely serve to limit the capacity of the elderly to adapt to a changing climate (Gamble et al., 2013). As a result, it is vital to develop climate change adaptation strategies that enhance the elderly's resilience to climate change.

Despite this need, there has been little research focused on designing and implementing adaptation strategies to enhance the resilience of the elderly to climate change. One notable exception is a recent article by Gamble et al. (2013) that considered the elderly's vulnerability to the impacts of climate change and offered a suite of recommended adaptation strategies. Their suggestions include:

- Map at risk elderly groups/individuals based on key vulnerability indicators to inform first responders.
- Conduct education and outreach efforts among the elderly with a focus on prevention and preparedness.
- Develop early warning systems and use multiple types of media to disseminate warnings about impending dangers.
- Incorporate physical design changes into neighborhoods.
- Distribute air conditioners or subsidize air conditioner use among vulnerable populations.
- Encourage those with special medical needs to register with emergency medical services to ensure that they receive needed services or assistance in an emergency.
- Follow emergency management best practices including utilizing principles of communication, effective emergency response planning and coordination, and targeted services.

These recommendations present an excellent starting point for considering measures to enhance the resilience of the elderly, but it is also important to note that they are based on an expert analysis of recent climate predictions, demographic data, and scholarly research focusing

on the elderly and climate related stressors. These recommendations do not incorporate the voice and perspective of the elderly. It is the elderly community, however, who has the most intimate knowledge of their vulnerability to climate related stressors as well as the potential effectiveness of strategies to safeguard them from those stressors. The type of "stakeholder" knowledge that the elderly possess has been shown in a variety of contexts to be of great value in fully understanding complex systems and developing innovative solutions (Beierle, 2002; Brody, 2003; Newig, 2007; Reed, 2007; Reed, 2008; Schusler & Decker, 2003; Sultana & Abeyasekera, 2008). Enhancing the elderly's resilience to climate change presents us with just such a complex system in need of innovative solutions and, if the perspective of the elderly is missing from the planning process, we risk developing poorly functioning adaptation strategies based on a limited understanding.

Mirroring the lack of the elderly's perspective in academic research, the elderly's voice may also be largely absent in practice as communities and institutions develop adaptation plans at various scales. A number of factors may serve to prevent the elderly, especially the most vulnerable among the elderly, from participating fully at the planning table. First, the elderly, especially those without relevant scientific or planning backgrounds, may not be invited to participate. Even if participation is open to the community, factors including chronic health conditions, impairments, financial limitations, and social isolation may make it difficult for elderly individuals to travel to planning meetings (Buchy & Hoverman, 2000; Tompkins & Hurlston, 2012). If they are able to attend, elderly individuals, especially those with cognitive impairments, mental decline, or diminished sensory awareness may find it difficult to comprehend or contribute to scientifically complex planning meetings (Larsen & Gunnarsson-Ostling, 2009).

If, as a result of any of these factors, the perspectives of the elderly are absent from adaptation planning, we run the risk of designing adaptation strategies that do not meet their needs. Furthermore, simply including a member or two from the elderly community as a representative stakeholder in a larger community-wide process could also prove insufficient to effectively incorporate their collective voice. Three primary causes contribute to this. First, the elderly community is diverse, with a broad range of characteristics contributing to their vulnerability. As a result, different elderly individuals will have different concerns and needs within the context of climate change. Simply incorporating a few representatives is unlikely to capture the breadth of perspectives and needs of the broader elderly community. Second, participatory processes can favor interests that are held in common by the entire participating group while overlooking those interests that are particular to minority groups within the community (Kothari, 2001; Mosse, 1995; Nelson & Wright, 1995). Many of the elderly's vulnerabilities are largely unique to their particular group, and so it may be a struggle to have these concerns addressed through such a venue. Third, participatory processes and their outcomes can reflect existing hierarchies and power dynamics within communities (Agarwal & Gibson, 1999; Mosse, 1994; Mosse 2001). Those with the most political power, financial resources, and formal education can wield the greatest influence during a participatory process and, intentionally or unintentionally, shape the outcomes to their ends (Eriksen et al., 2010; Measham et al., 2011; Reid et al., 2009; Sanders, 1997). This is often at the disadvantage of marginalized and vulnerable groups who might be in most need of assistance. While the relative power and influence of elderly individuals will vary greatly within communities, the most vulnerable elderly are also likely to be the most marginalized, with the least influence, little formal education, and limited financial resources. As a result, community-wide participatory

processes may still fail to fully bring forth the voices of the elderly community into adaptation planning.

One approach that adaptation practitioners can use to strengthen the voice of the elderly in the adaptation process is to work specifically with elderly communities to develop their concerns and recommendations. This can help the elderly community increase their familiarity with the relevant subject matter and their comfort contributing to public processes. It also provides them an opportunity to assemble their collective first hand knowledge, develop their perspective, explore nuances within their community, collaboratively develop innovative solutions, and internally prioritize their needs. The results of such a process can then be brought to and advocated for in larger adaptation planning processes.

Focusing initially on marginalized and vulnerable groups to develop their concerns and then bringing those concerns to the larger community is an approach that has been used successfully in the broader field of public participation (Guijt, Kisadha, & Mukasa, 1998) as well as in the context of participatory climate change adaptation planning (Figueiredo & Perkins, 2012). In the latter example, women living in Brazil and multiple African countries were engaged in an inclusive process to consider the impacts of climate change on water management. Such an approach has promise in the context of the elderly and climate change, as well as with other marginalized and vulnerable groups.

In addition to developing targeted and informed adaptation strategies, such an approach can have additional benefits that could serve to enhance resilience among the elderly community. While research on this subject in regard to the elderly is currently scant, similar benefits have been found as a result of participatory adaptation processes more generally (Albert, Zimmermann, Kneiling, & von Haaren, 2012; Cloutier & Joerin, 2012; Dumaru, 2010; Frazier,

Wood, & Yarnal, 2010; Gero, Meheux, & Dominey-Howes, 2011). For example, participatory adaptation planning has been shown to raise awareness among participants of predicted climate change impacts and increase their understanding of potential adaptation strategies (Albert et al., 2012; Cloutier & Joerin, 2012; Dumaru, 2010). Participatory adaptation planning has also been shown to result in increased communication and coordination among relevant stakeholders (Albert et al., 2012; Gero et al., 2011).

In an effort to provide insight into the role of climate change adaptation in safeguarding the elderly, this paper presents the results of a participatory adaptation planning process conducted in collaboration with the elderly community of Bridgeport, Connecticut. To this end, this research has two main goals. First, it seeks to develop a context-specific set of prioritized adaptation strategies driven by the elderly's perspective. Second, the research seeks to assess a potential process for promoting and addressing the needs and concerns of the elderly as a vulnerable group within a larger community.

Methods

Site description and summary of previous research. Bridgeport is located in southwestern Connecticut along Long Island Sound and is the fifth largest city in New England (Figure 1). There are numerous aspects to the city that make it an advantageous case for investigating climate change adaptation and the elderly. First, Bridgeport is home to a sizable elderly population, with over 16,000 residents age 65 or greater, which encompasses a diverse socio-economic range (US Census Bureau, 2012). Second, its urban built environment and location on Long Island Sound make it subject to multiple climate related stressors that pose particular challenges for elderly residents. These include stressors associated with extreme heat,

increased precipitation, rising sea levels, and decreased air quality (Horton et al., 2014). Third, the city's ongoing leadership in addressing climate change presents an opportunity to attempt to integrate the elders' recommendation with ongoing community-wide efforts (City of Bridgeport, 2012).

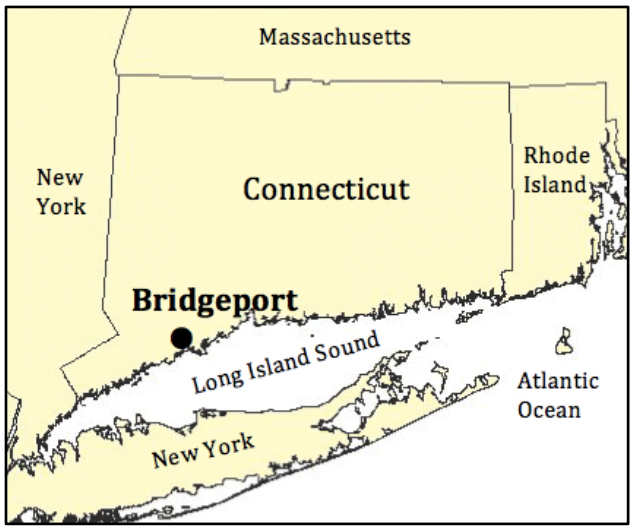

Figure 1. Map showing the location of Bridgeport, Connecticut. Base map prepared by the State of Connecticut Department of Energy and Environmental Protection (2013) and is in the public domain.

The current research built on a participatory investigation conducted in partnership with the same community examining their vulnerability to climate change (Rhoades, Gruber, & Horton, 2016). For this examination, 55 elderly residents of Bridgeport, who comprised a diverse representation of the city's elderly population, met for two open vulnerability assessment meetings where they considered the following questions:

- How are they currently impacted by major climate stressors?
- What factors contribute to their vulnerability to those stressors?
- What strategies do they currently employ to prepare for, cope with, and recover from the impacts of those stressors?
- How might predicted climate changes impact them?

Through a discussion-based process drawing from community-based action research methods presented in Stringer (2007) and the vulnerability assessment research of Ford and Smit (2004) participants developed an in-depth picture of their vulnerability to climate change. The results of this process are described in greater detail in Rhoades, Gruber, and Horton (2016). However, as summarized in Table 1, participants described their vulnerability to climate change as a result of a combination of personal characteristics interacting with multiple contextual factors that serve to exacerbate or mitigate the challenges that climate related stressors pose for them. Participants noted personal impacts from climate stressors ranging from illness and injury to financial losses and property damage. They also highlighted concerns that future climate changes could easily overwhelm their adaptive capacity.

Table 1. *Personal characteristics and contextual factors influencing the vulnerability of elderly individuals in Bridgeport to climate related stressors.*

Personal Characteristics	Chronic health conditions
	Physical/cognitive impairments
	Social Isolation
	Economic limitations
	Marginalization (language, race, income and education levels)
Contextual Factors	Adequacy of transportation resources
	Effectiveness of warning mechanisms
	Availability of resources to promote safe shelter
	Adequacy of resources to aid in coping and recovery

Note: Summarized from Rhoades, Gruber, and Horton (2016). Permission documentation can be found in Appendix L.

Based on the results of this inquiry, and in an effort to help prioritize future adaptation planning, the meeting participants collaborated with the lead researcher to develop a Likert scale survey to allow the broader elderly community of Bridgeport to voice their concerns. Questions on the survey were organized into six focus areas:

1. Concerns over receiving adequate warning prior to extreme weather.

2. Concerns over staying safe at home during extreme weather.
3. Concerns over having adequate transportation resources.
4. Concerns over finding safe shelter.
5. Concerns over getting needed assistance.
6. Concerns over having resources to aid in the recovery process.

Multiple questions in each focus area solicited respondents' perspectives on specific issues associated with the topic. A total of forty questions focusing on participants concerns were included in the survey. For each question, respondents were requested to rank their level of concern on a scale of one to five, with one representing a lack of concern and five representing a very high level of concern.

Results of the survey, completed by 164 respondents, indicate a diverse suite of concerns over climate related stressors with all of the 40 questions being ranked as a high concern (a four or five on the five point Likert scale) by over 15% of all respondents. While the results of this survey are described in more detail in Rhoades, Gruber, and Horton (2016), in brief some of the most pressing concerns were associated with receiving adequate warning, including concern over not receiving warnings, as well as warnings being difficult to understand or not containing adequate information. Greater levels of concern were also associated with securing safe shelter, including concerns over the safety of places of residence, as well as the accessibility, safety, and comfort of shelter locations. Finally, participants expressed particular concern over factors associated with getting assistance and recovering during and after climate related stressors. These included concerns connected to traveling to the hospital, acquiring needed food and supplies, accomplishing essential tasks without electricity, coping with trauma and stress, and conducting repairs and clean up following storms or flooding.

Adaptation planning process and summative evaluation. In response to the meeting and survey results, two adaptation planning meetings were held with the elderly community of

Bridgeport to develop strategies to promote their resilience. As with the previous meetings, these meetings were held at the centrally located Eisenhower Senior Center and were open to any member of the elderly community of Bridgeport who wished to attend. Outreach was conducted by the city's three seniors centers to encourage a broad range of attendance and demographic data was collected at both meetings to ensure that a diverse representation of the elderly community was included in the meetings. City staff from the Department on Aging and the Office of Emergency Management and Homeland Security also attended the meetings to assist participants in developing adaptation strategies by providing additional context regarding existing city programs.

The two meetings followed the adaptation planning approaches and best practices described in Gruber et al. (2015), the NRC (2010), Snover et al. (2008). First, participants developed a set of general guiding goals for the overall adaptation effort and then continued to develop specific measures that could further those goals. In developing and later prioritizing the recommendations, participants utilized the following recommendations put forth in the above cited research:

- Utilize, modify, or partner with existing programs.
- Enlist outside partners.
- Develop multiple overlapping approaches to enhance the resilience.
- Focus on actions that achieve multiple benefits both within and outside of the context of climate change.

An initial set of recommendations developed at the first adaptation planning meeting was summarized and presented at the second meeting to elicit additional feedback and to prioritize the various recommendations. To prioritize the recommendations, participants considered the potential of each recommendation to have a positive impact on reducing risk among the elderly as well as its potential feasibility of implementation. Participants ranked both impact and

feasibility on a Likert scale of one to five, with one representing an recommendation with low potential impact or feasibility and five representing a recommendation with high potential impact or feasibility. This approach is similar to more standard cost-benefit/risk reduction analyses that are described by the NRC (2010), but expanding the consideration of "cost" to include "feasibility" allows participants to consider additional institutional and cultural constraints to implementation (Gruber et al., 2015). The impact and feasibility assessments were averaged separately for the participating elders and the participating city staff. Those actions scoring highest in both potential impact and feasibility were considered the highest priority options.

In addition to the planning efforts, a summative evaluation was conducted to assess the outcomes of the project in terms of enhancing the elderly's resilience to climate change (Davidson, 2005). Focus areas of the summative evaluation included:

1. How are the participants' adaptation recommendations received by the city of Bridgeport and what is the likelihood that the city moving forward with implementation?
2. Do participants believe that the adaptation recommendations reflect the needs and concerns of the elderly?
3. Do participants believe that the adaptation recommendations will help keep Bridgeport's seniors safer?
4. Did the project improve participants' awareness of the risks posed by climate change?
5. Did the project increase participants' knowledge about what actions they could take to protect themselves?
6. Did the project enhance their ability to self-advocate for their needs?
7. Did the project increase the awareness among relevant support groups of the risks that climate change poses for the elderly in their community?
8. Did the project lead to increased communication among relevant support groups about protecting the elderly community from the risks that climate changes poses?

In investigating these questions, a combination of participant observation, Likert scale surveys, semi-structured interviews, and semi-structured focus group interviews were utilized following basic evaluation protocols described in Davidson (2005) and Patton (1987).

Specifically, at the end of the project, elderly participants indicated their level of agreement with questions two through six by responding to an anonymous five point Likert scale survey where a ranking of one indicated strong disagreement and a ranking of five indicated strong agreement with the respective question. Questions two through six were also discussed with elderly meeting participants during a semi-structured focus group interview. Questions one, seven and eight were discussed with representatives from the participating city agencies during semi-structured interviews. Participant observation was conducted throughout the adaptation planning process by the lead researcher to supplement and triangulate the survey and interview data. The results of the evaluation were shared with the elderly participants and representatives from city agencies for their review and their input was included in the final results.

The focus of this research on a single community prevents generalization to the broader elderly population. Some of its findings, however, may be transferable to other elderly communities. The potential transferability and limitations of the findings are addressed in greater detail in the conclusion section.

Results and Discussion

Meeting participants. A total of 37 elders participated over the course of the two adaptation planning meetings. The demographic data collected shows that the participants comprised a diverse representation of the elderly community of Bridgeport (Table 2). The data also shows that elderly with characteristics that put them at particularly heightened risk to climate change were included in the planning. These included individuals with limited economic resources, little formal education, minorities, and those living with disabilities.

Table 2. *Demographic comparison of adaptation planning meeting participants with general elderly population of Bridgeport.*

Category	**Meeting participants**	**Elderly population in Bridgeport (*n=37*)**
Age (Average)	74.4	74.2
Age by Cohort (%)		
65-74	53.1	n/a
75-84	28.1	n/a
85+	18.8	n/a
Gender (%)		
Female	74.3	60.8
Male	25.7	39.2
Race (%)		
Asian	3.0	2.8
Black or African American	73.5	28.3
White	23.5	63.3
Other	0	5.6
Hispanic or Latino (%)	7.7	22.1
Living Alone (%)	48.6	59.9
Educational Attainment (%)		
Less than a High School degree	35.3	41.3
High School degree or equivalent	41.2	34.1
Some college/associates degree	17.6	14.6
Bachelors degree or higher	5.9	10.1
Living With a Disability (%)	58.8	41
Primary language (%)		
English	88.6	n/a
Spanish	5.7	n/a
Portuguese	2.9	n/a
Chinese	2.9	n/a
Speak English less than very well (%)	11.1	29
Employment (%)		
Full or part time	14.3	15.9
Unemployed or retired	85.7	84.1
Household income (%)		
Less than $10,000	53.6	n/a
$10,000-$20,000	35.7	n/a
$20,000-$40,000	10.7	n/a
$40,000+	0	n/a
Housing status (%)		
Owner occupied	55.2	55.6

Renter occupied	44.8	44.4

Note: Data for the general elderly population in Bridgeport is taken from the US Census Bureau's American Community Survey (2012).

Adaptation goals. With the aim of inclusively addressing the diverse characteristics and factors that contribute the vulnerability of the elderly as well as their broad concerns, participants developed six general adaptation goals (Table 3).

Table 3. *Climate change adaptation goals developed by elderly meeting participants*.

1. Encourage preparedness among seniors for extreme weather and other emergencies.
2. Provide effective warnings for seniors of extreme weather and other emergencies.
3. Provide seniors with resources for securing safe shelter.
4. Provide transportation resources that meet seniors' unique needs.
5. Provide resources to help seniors accomplish essential tasks during and following extreme weather.
6. Provide resources to aid seniors in the recovery process.

Encourage preparedness among seniors for extreme weather and other emergencies. For the elderly to stay safe during extreme weather and other emergencies, the participants indicated that it is vital that they are well prepared. They explained that this includes knowing what to do in an emergency, having needed supplies on hand, and being aware of resources to aid in preparing for, coping with, and recovering from extreme weather. They also noted that preparedness measures need to focus on the unique causes of vulnerability among the elderly population.

Provide effective warnings for seniors of extreme weather and other emergencies. Participants shared that, when extreme weather is predicted, it is vital that the elderly receive adequate warning to prepare. This necessitates finding strategies to distribute warnings even to socially isolated elders who have limited use of communication technologies. Additionally, they recommended that warnings need to be clearly understandable by the elderly despite potential

sensory or cognitive impairments. Warnings also need to contain information relevant to the elderly about what they can do to protect themselves.

Provide seniors with resources for securing safe shelter. Participants noted that, due to the elderly's heightened vulnerability to climate change, it is important for them to be able to access safe shelter in the event of extreme weather. In some cases, elders may feel comfortable taking shelter at their home and it is important to develop resources to promote this. In other cases, it will be important for them to be able to access emergency shelters and cooling centers. In addition to accessibility, participants highlighted that it is important that elders feel safe and comfortable in these locations.

Provide transportation resources that meet seniors' unique needs. Participants noted that transportation plays an important role in helping many elders prepare for, cope with, and recover from extreme weather. This can include gathering needed supplies to prepare for predicted weather, evacuating in an emergency, or accessing needed medical treatment following an injury or illness. Participants also highlighted that transportation can be a significant challenge for the elderly, as many elders can not drive, lack the expendable income to pay for transportation services, and/or have disabilities and medical conditions that can make travel difficult. Participants emphasized that there needs to be affordable and accessible public transportation resources that can accommodate the unique needs of elderly individuals travelling with disabilities or who may need to bring medical equipment or supplies with them.

Provide resources to help seniors accomplish essential tasks during and following extreme weather. Participants noted that the elderly may face significant challenges accomplishing essential tasks during or following extreme weather and other climate related stressors. This is an especially pressing concern for socially isolated elders. They suggested that

it is important to have resources to support seniors both during and following such events to ensure that they are safe and able to accomplish essential tasks to maintain their well being.

Provide resources to aid seniors in the recovery process. Participants noted that elderly individuals can face significant challenges recovering from extreme weather and other climate related stressors. This can be a result of multiple factors including financial limitations, physical and mental impairments, difficulties travelling, and social isolation. Participants highlighted the importance of resources to aid elderly individuals in the recovery process. They also emphasized that elders need to be aware of these resources and need to be able to navigate the processes needed to access them.

Recommended adaptation strategies. To achieve these goals, participants developed seven initial adaptation recommendations (Table 4).

Table 4. *Adaptation recommendations developed by elderly meeting participants.*

1. Provide emergency preparedness trainings specifically for seniors.
2. Develop and distribute emergency preparedness informational materials specifically for seniors.
3. Conduct a reverse 911 sign up drive targeted at seniors.
4. Tailor warnings to meet seniors' needs.
5. Tailor shelters to meet seniors' needs.
6. Promote volunteer ridesharing and transportation assistance.
7. Establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors.

Provide emergency preparedness trainings specifically for seniors. To help promote preparedness, the participants recommend that the city of Bridgeport develop and present emergency preparedness trainings designed specifically for seniors. They suggested that these trainings focus on hazards associated with extreme weather including extreme heat, flooding and storms, and air pollution. Potential locations for the trainings include senior centers, houses of worship, schools, and libraries. In considering locations for the trainings, participants

highlighted accessibility via public transportation as well as adequate parking as important factors.

Among the information important for the elderly community, participants recommended including information on existing resources that can help seniors prepare for and cope with climate related stressors, such as shelter locations, transportation resources available in emergency situations, resources to help individuals fill prescriptions during emergencies, and the relevant emergency phone numbers. They recommended including information on how to sign up for priority electricity restoration with the electric company and how to sign up with the city for the Reverse 911 program, which automatically calls people on their phones with emergency warnings. They suggested including information on resources to help with the recovery process, including programs targeted at providing physical and mental health services as well as programs designed to provide food, in home assistance, and home repair. They recommended including information on the amount of prescription medication to have on hand as well as how to fulfill prescriptions in an emergency.

They suggested that it would be beneficial for the elderly to learn about emergency preparedness steps that they should take. These could include how to develop an emergency preparedness plan, what to put in a preparedness kit, what supplies to have at home in case of an emergency, and how to create low cost emergency preparedness tools or "hacks" that can provide important services in an emergency. This last suggestion, including creative solutions such as filling a cooler with ice and placing a fan on top to provide low cost air conditioning during a heat wave, has great potential to keep elders with financial limitations safe. As part of developing an emergency preparedness plan, participants suggested that elderly individual's establish a "buddy" to aid them in dealing with extreme weather. Principally, this buddy could

make sure they are aware of and prepared for upcoming threats and check in on them during and following climate related stressors or other emergencies.

Participants suggested a diverse outreach strategy for the trainings to encourage strong attendance among the elderly population. First, they suggested distributing multilingual fliers to promote the trainings through a diverse set of organizations that interact with the elderly. Specifically, they recommended the city's senior centers, houses of worship, local hospitals, the YMCA, as well as local affiliates of elderly support organizations including AARP, Meals on Wheels, and the Visiting Nurses Association. To reach diverse elders with varying technological capacities, they suggested promoting the event through social media and by posting fliers at drug stores and grocery stores. In these promotions, they noted the importance of advertising free refreshments, which would serve as an effective incentive to attract elders to the trainings.

Develop and distribute emergency preparedness informational materials specifically for seniors. In addition to the trainings, participants suggested that it is important for elderly individuals to have information on hand to help them in preparing for, coping with, and recovering from extreme weather and other emergencies. To help provide this, they suggested that the city of Bridgeport develop and distribute print materials with emergency preparedness information and relevant resources for the elderly. Participants recommended providing the information in two formats, a refrigerator magnet and a booklet. On the magnet, they recommended presenting the most important emergency phone numbers. For the booklet, they suggested preparing a condensed collection of the same information they recommended for the preparedness trainings, including relevant resources and preparedness measures. For both the magnet and booklet, they highlighted that the material should be targeted at elders' unique needs and should be presented in large font. Participants recommended distributing the materials

through multiple organizations and locations including the senior centers, houses of worship, hospitals, the YMCA, AARP, Meals on Wheels, and the Visiting Nurses Association. They also noted it would be helpful to hand out these materials at the emergency preparedness trainings.

Conduct a reverse 911 sign up drive targeted at seniors. To help provide adequate warning of potentially hazardous events, participants suggested conducting a sign up drive to enroll elders in the city's "Reverse 911" program, which calls registered individuals on their home phone with warnings and notices. In an additional survey question, a plurality of the 164 elderly respondents (38%) ranked telephone calls as their preferred way to receive warnings. The Reverse 911 program offers an easy and effective way for elderly individuals to receive warnings over the phone. To ensure that this program reaches as many people as possible, the participants suggested that the city of Bridgeport partner with additional organizations to conduct a reverse 911 sign up drive targeted specifically at the elderly population. They recommended distributing multilingual fliers to promote the event through organizations including senior centers, houses of worship, local hospitals, the YMCA, AARP, Meals on Wheels, and the Visiting Nurses Association. They recommended posting fliers advertising the event at local grocery and drug stores. In addition they recommended using social media and local TV stations to promote the sign up drive.

Tailor warnings to meet seniors' needs. To help ensure that warnings are clear and informative for the elderly, they suggested a set of guidelines for the city of Bridgeport to follow when issuing warnings, including those distributed by Reverse 911. First, warnings should be given in a slow and clear message and then repeated. Second, warnings need to contain information relevant to the elderly, including shelter locations, as well as transportation and medical resources as needed. Third, warnings need to be given in multiple languages. These

guidelines could also be shared with local radio and TV stations. In addition, it would be beneficial if warnings airing on the TV were also displayed as text at the bottom of the screen.

Tailor shelters to meet seniors' needs. Participants suggested multiple actions to increase the accessibility and comfort of shelters. To increase the accessibility of shelters, participants recommended that the city seek to develop additional shelter locations. In particular, they suggested that the city could encourage houses of worship to become official emergency shelters. Participants selected houses of worship as good potential partners because they are spread across the city and many elders are familiar with their locations and would be comfortable traveling and staying at one in a time of need. The primary action this would require on the part of the houses of worship would be to install a generator to provide ongoing electricity in case of a power outage. Along with developing additional shelters through this partnership, participants also suggested that the city take steps to make shelters more comfortable for the elderly community. Specifically, they recommended playing soothing music and offering snacks.

Promote volunteer ridesharing and transportation assistance. To help provide additional transportation resources for the elderly, participants suggested that the city of Bridgeport establish a volunteer program that provides rides to elders. Potential volunteers could be vetted by the city and then, if approved, could be placed on a roster of individuals willing to provide rides for elders. As part of this process, volunteers could specify their hours of availability and elders could call a central number to request a ride. Similar programs exist in other areas that could serve as examples to guide the development of this program.

Establish a telephone-based clearinghouse for extreme weather and emergency related resources for seniors. Many resources are currently available to meet elders needs before, during, and following extreme weather and other climate related stressors, but elders are often

unaware of them or can have difficulty navigating computer technology to identify and access those resources. To address these challenges, participants suggested that the city of Bridgeport establish an extreme weather/emergency informational phone number that could serve as a clearinghouse for the elderly community's questions and needs. This number would be intended to connect elders to information and resources, not to serve as an emergency number such as 911. Elders calling the number could be presented with a menu of resource options that they could choose from. These could include transportation resources, medical resources, nutrition resources, recovery resources, and mental health resources. After selecting an option, elders could be provided contact information to various organizations and programs that provide those services. This number could also be an avenue for elders to share concerns and requests with the city.

Utilization of best practices in the adaptation recommendations. These recommendations address a broad range of factors that can promote resilience among the elderly. In developing the recommendations, participants were able to incorporate many of the best practices described in Gruber et al. (2015), the NRC (2010), and Snover et al. (2008). These best practices include utilizing and tailoring existing programs, enlisting outside partners, developing multiple overlapping approaches to promote resilience, and focusing on actions with multiple benefits.

A number of these adaptation recommendations utilize existing programs to help build resilience. Much good work was already being done in the city and the adaptation recommendations aim to further these efforts by tailoring these programs to meet the elderly's needs and conducting outreach efforts to encourage greater awareness among the elderly community. For example, preparedness trainings have been delivered at the senior centers

previously, but were not as thoroughly tailored to their unique needs. Additionally, elders had been previously encouraged to sign up for Reverse 911, but not as part of a targeted and concerted effort as envisioned in the current recommendation. In comparison to developing new programs, utilizing and tailoring these existing programs will greatly improve the efficiency of the city's efforts by reducing cost and speeding up delivery.

In addition to utilizing existing programs, the recommendations also seek to integrate additional partners in the effort to promote resilience among the elderly. For example, recommendation five suggests encouraging houses of worship to become official shelter and cooling center locations. Such buildings could be ideal partners and would expand the scope of the city's shelters and cooling centers. In addition, multiple partners, including the local hospital, the YMCA, AARP, Meals on Wheels, and the Visiting Nurses Association were repeatedly mentioned as valuable partners to enlist in outreach campaigns. Such an approach can extend the city's reach to a greater number of sub-groups within the elderly community, while also building stronger partnerships for future collaborations.

The above strategies utilize multiple and overlapping approaches to enhance resilience among the elderly community. As a result, the resilience of the community is not dependent on the success or failure of one key initiative; rather multiple, interacting, and overlapping strategies are proposed so that even if some of the strategies prove ineffective, other strategies can still serve to safeguard elders. For example, to encourage preparedness and increase awareness of available recourses, the strategies do not only recommend emergency preparedness trainings, but also call for distributing informational materials and establishing a telephone-based clearinghouse for information and resource requests. With this redundant and multi-pronged approach, a greater number of elders will encounter and be able to utilize the information.

Finally, a number of the recommendations provide multiple benefits in the contexts of differing climate futures. Such actions are sometimes referred to as "no-regret solutions" highlighting that their implementation will be beneficial even if the predicted climate changes on which they are based do not occur (IPCC, 2007). One example is recommendation six, focused on developing a volunteer ridesharing program. This potential program could be a great benefit to the elderly on a daily basis as well as in relation to climate related stressors. Additionally, all of the measures focused on encouraging emergency preparedness will be useful in the context of a range of emergencies and disasters in addition to those that may be associated with a changing climate. Finally, even a simple suggestion like encouraging elders to enlist a "buddy" to check on them during and following climate related stressors could have the added benefit of reducing social isolation. These benefits support many of the focus areas of the World Health Organization's Age Friendly Cities Program, including improving transportation, communication and information, and community support and health services (World Health Organization, 2007).

Prioritizing the adaptation recommendations. As a means of prioritizing the most promising adaptation strategies, 35 elderly participants ranked each of these recommendations based on their potential positive impact reducing the risk climate change poses to the elderly community of Bridgeport. They also ranked each recommendation in terms of its potential feasibility to implement. These two factors were ranked on a scale of one to five, with a ranking of five denoting recommendations with the highest potential impact or feasibility and one denoting those with the least potential in either regard. To provide another lens on these questions, seven city staff from the Department on Aging as well as the Office of Emergency Management and Homeland Security separately ranked each suggestion's impact and feasibility.

The rankings were then averaged for each group to produce two sets of overall scores for each recommendation (Table 5).

Table 5. *Average impact and feasibility rankings for each adaptation recommendations as indicated by elderly participants and city staff.*

Adaptation Recommendations	Elderly Participants (*n=35*)		City Staff (*n=7*)	
	Impact	**Feasibility**	**Impact**	**Feasibility**
1. Provide emergency preparedness trainings specifically for seniors	4.6	4	4.7	3.7
2. Develop and distribute emergency preparedness informational materials specifically for seniors.	4.7	4.2	5	4.3
3. Conduct a reverse 911 sign up drive targeted at seniors.	4.5	4	4.3	3.6
4. Tailor warnings to meet seniors' needs.	4.6	4.5	4.7	4.7
5. Tailor shelters to meet seniors' needs.	4.3	4	4.3	4.4
6. Promote volunteer ridesharing and transportation assistance.	4.1	3.7	4.2	4.4
7. Establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors.	4.5	4.2	4.6	4.7

Note: For the Likert scale, 1=low impact/feasibility and 5=high impact/feasibility.

All of the recommendations received high marks for their potential impact as well as their feasibility from both the elderly participants and the city staff. Given their high rankings in both regards, it would appear that all of the recommendations warrant further development. Adaptation recommendations two, four, and seven (develop and distribute emergency preparedness informational materials specifically for seniors, tailor warnings to meet seniors' needs, and establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors) received the highest rankings. I posit that focusing initially on the implementation of these recommendations might be an advantageous first step that could help generate significant early successes thereby bolstering support for future efforts.

Bringing participants concerns to the larger community. An important aim of this study was to explore the utility of conducting a participatory process with a vulnerable group within a community and then bringing the recommendations of that process to the larger community. In this case, the question was: would the city be responsive to the adaptation measures recommended by the elderly participants? While little time has passed since the elderly participants developed their recommendations and therefore it is difficult to fully assess the city's responsiveness, the initial outlook is positive. The city's Office of Emergency Management and Homeland Security has already developed and presented its first emergency preparedness training specifically for the elderly based on the participants' recommendations. The city has also prepared and is beginning to distribute preparedness informational materials for the elderly community based on the participants' recommendations. In an effort to keep awareness high among the elderly community, the Department on Aging also plans to begin including a page in their regular newsletter focused on extreme weather and emergency preparedness.

City staff indicated that their eagerness to implement the recommendations was a result of multiple factors. First, the city was already focused on issues of climate change and preparedness. As a result, they welcomed the opportunity to gain new insight to improve their efforts. Also, the opportunity to hear directly from the elderly community themselves produced information both relevant and illuminating to their efforts. Additionally, the recommendations' focus on enhancing and tailoring existing efforts enhanced their feasibility from the city's perspective.

Additional benefits of the participatory planning process. I posit that these adaptation recommendations and their implementation hold great promise to enhance the resilience of

Bridgeport's elderly community. Additionally, as evidenced by the summative evaluation, the elderly participants indicated unanimously that the recommendations reflected the needs and concerns of the elderly and would help make Bridgeport's elderly community safer (Table 6). Results from the summative evaluation also indicate that the project had numerous additional benefits. Specifically, the project improved seniors awareness of the risks posed by climate change, increased their knowledge about what actions they could take to protect themselves, and enhanced their ability to advocate for their needs in this context (Table 6). Interviews with representatives from participating city agencies conducted as part of the summative evaluation also illustrates that the project increased the awareness among relevant support groups of the risks that climate change poses for the elderly in their community, and increased communication among those groups regarding efforts to protect the elderly community from those risks. Each of these benefits will be discussed in turn.

Table 6. *Elderly participant responses to project evaluation questions.* (*n=35).*

Evaluation Statements	**Average level of agreement**
The recommendations of this project reflect the concerns and needs of the elderly.	5.0
The recommendations of this project will help make Bridgeport's seniors safer.	5.0
As a result of this project, I am more aware of how changes in extreme weather may affect seniors in Bridgeport.	5.0
As a result of this project, I am more knowledgeable about how to protect myself from the impacts of extreme weather.	4.7
As a result of this project, I am better able to advocate for what I need to stay safe during extreme weather.	4.7

Note: For the Likert scale, 1=strong disagreement and 5 = strong agreement.

Increasing awareness among the elderly about climate related risks. As a result of their participation in the project, 35 participants unanimously indicated their strong agreement that

they were more aware of how changes in extreme weather may affect the elderly in Bridgeport (Table 6). Observations of the process, as well as comments from the elderly participants, support that this was the case. During the course of the planning process, elderly participants reviewed trends in historical climate data and predicted climate changes for the area. The lead researcher also observed participants engaging in a collaborative dialogue with each other to discuss how climate related stressors impact them and the risks associated with climate change. As one participant explained, "I had no idea weather had changed so much and what is predicted to happen."

Increasing knowledge among the elderly about protective actions. Participants again indicated strong agreement that the project increased their knowledge about ways to protect themselves from the impacts of extreme weather (Table 6). Throughout the process, participants discussed current strategies that they use to protect themselves from climate related stressors and also developed additional approaches. In addition, they were able to ask questions of attending city staff from the Office of Emergency Management and Homeland Security as well as the Department on Aging. Through these interactions, the lead researcher observed participants learning of many resources of which they were not previously aware. One participant commented, "Learning about the emergency numbers to call and the city's different programs was very helpful…I didn't know those resources existed."

Enhancing the elderly's ability to self-advocate. Participants indicated an enhanced ability to advocate for their needs with regards to extreme weather and climate change (Table 6). Through this process, the elderly participants developed an understanding of the risks that climate change poses for them. By engaging with the other participants in a collaborative process, the lead researcher observed the elderly participants learning about the needs and

concerns of their fellow elders and developing a common vision and set of actions to promote their resilience in a time of climate change. As one elder described, with this increased understanding of the risks they and their community face, as well as a common vision and priorities, she felt "more comfortable sharing my thoughts and opinions." I contend that this ability to self-advocate could be instrumental in keeping the attention of relevant city staff and support organizations focused on the needs and concerns of the elderly.

Increasing awareness among elderly support groups. Observation of the process as well as interviews with representatives from participating city agencies demonstrate that the process increased the awareness among elderly support groups of the risks that climate change poses for the elderly in their community. While assisting in the process at varying points, multiple organizations that play important roles supporting the elderly were exposed to information about the potential impacts of climate change on the elderly. Included among these groups are the local Meals on Wheels provider, the local Visiting Nurses Association, the Bridgeport YMCA, a major local hospital, houses of worship, as well as the city of Bridgeport's Office of Emergency Management and Homeland Security, Department on Aging, and Office of Sustainability. Furthermore, through their ongoing engagement in the planning meetings themselves, the lead researcher observed that participants from the Office of Emergency Management and Homeland Security as well as the Department on Aging were exposed to an in-depth exploration of both the risks and recommended adaptation strategies identified by the elderly participants. A staff member from the Department on Aging noted, "We don't really think about issues like this that much until something like a crisis occurs or a project like this comes about to revisit those preparation skills." Staff from the Office of Emergency Management and Homeland Security concurred, "After all these conversations and dialogue, it's

at the forefront of my mind and these people are very important in every aspect of an emergency, especially at that age."

It is worth noting that, in addition to raising awareness about the challenges that the elderly face, the project also exposed the support groups directly to the elderly participants' perspectives of these challenges. A comment from a staff member within the Office of Emergency Management and Homeland Security captures the importance of such first hand knowledge in effective emergency preparedness:

> "A lot of times in our field we talk about vulnerable populations, however most of us who do this line of work just don't fall into those categories and we read a lot about it and review best practices, but each community's vulnerable populations are so different, to hear it from the horse's mouth is a lot better and gives you more of a positive operations standpoint rather than just implementing what you think would work for seniors."

I suggest that this awareness of the needs and concerns of the elderly from their perspective could be very valuable when designing and undertaking adaptation efforts in the city.

Increasing communication among elderly support groups. In addition to increasing awareness among elderly support groups, the lead researcher observed that participation in the process also increased communication among those groups about these issues. Interviews with staff from participating city agencies confirm this increase in communication. In particular, the Department on Aging and the Office of Emergency Management and Homeland Security both regularly attended the planning meetings and have been in ongoing communication about the issues raised. Through this communication, the two organizations were able to partner to offer an initial emergency preparedness training for the elderly at the city's main senior center. As a staff member from the Department on Aging indicated, they plan to remain in communication with the Office of Emergency Management and Homeland Security and keep focused on the issue. Staff from the Office of Emergency Management and Homeland Security concurred,

adding that the project has led to a lot more fluid communication with the two departments now checking in on a variety of issues. The staff member added, "I have that first name basis relationship and don't feel like I have to be very formal in contacting them, but can just show up and tell them what some of my suggestions are or what we need, or some activity that we are thinking about." I posit that the increased communication and collaboration among these groups can help facilitate more effective measures to safeguard the elderly from climate change.

Upholding the dignity of the elderly. In addition to the above benefits of the participatory adaptation planning process, it is worth noting that including the elderly as participants upholds their inherent dignity. Rather than viewing the elderly as vulnerable research subjects in need of assistance, this process valued the elderly as stakeholders with expert knowledge about their vulnerability to climate change and a first hand understanding of the most effective measures to enhance their resilience. The importance of this dignified position to the elderly was captured by one participant who, at the close of a meeting, simply stated, "Thank you for thinking of us and including us."

Conclusion

Climate change poses serious risks to the elderly. Due to a variety of factors that can limit their adaptive capacity, many elderly individuals will be especially dependent on a range of support services to safeguard them from those risks. This case study provides insights into the kinds of adaptation strategies that are recommended by an elderly community to enhance their resilience to climate change. It also demonstrates the numerous potential benefits of incorporating the elderly as active participants in the adaptation process. These benefits include raising awareness and understanding among the elderly participants and city agencies, enhancing

communication among relevant organizations, and increasing the elderly participants' ability to self-advocate.

This is only a single study and it is likely that preferred adaptation strategies will vary greatly from one community to the next based on relevant climate stressors, the socioeconomic conditions of the elderly population, and the currently available support services. The adaptation recommendations, however, could be relevant in other communities and these recommendations could contribute to an initial understanding of potential adaptive measures applicable in other communities with similar challenges and concerns. In particular, the recommendations may be most relevant in other northeastern cities also with large elderly populations and facing similar climate stressors to Bridgeport.

Additionally, despite this being only a single case study, it is not unreasonable to speculate that many of the benefits of including the elderly as participants in the adaptation planning process could also be achieved through similar participatory processes in other communities. This potential is evidenced by research demonstrating similar positive outcomes of participatory processes in a variety of contexts (Albert et al., 2012; Cloutier & Joerin, 2012; Dumaru, 2010; Frazier et al., 2010; Gero et al., 2011).

To further develop our understanding of adaptation strategies that best reflect the needs and concerns of elderly and will keep them safe under a variety of conditions, it will be important for researchers to work with elderly communities in diverse contexts. Such research could also investigate the additional benefits of these participatory approaches to better understand under what conditions various benefits are more or less likely to be achieved.

It is also important to note that, under any circumstances, for recommended adaptation strategies to actually protect the elderly, they need to be acted upon by those in the proper

institutional positions. In this regard, the city of Bridgeport should be applauded for their responsiveness and willingness to act on the participants' recommendations. By turning the adaptation plan into tangible and targeted actions, they have taken important steps to protect their elderly citizens from the impacts of climate change. Through similar processes in other communities, and with similarly engaged and supportive partners, it is hoped that we can move forward to greatly enhance the elderly's resilience in this time of risk and change.

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Preface to Chapter 6

Chapter Six is written in journal article format. It continues the summative evaluation of the project partially described in Chapter Five. While the aspects of the evaluation presented in Chapter Five focused predominantly on the outcomes of the project, the aspects of the evaluation presented in Chapter Six focus more heavily on the process itself. Specifically, it addresses the primary research question:

- What are beneficial characteristics and key challenges when working with the elderly on climate change adaptation planning in Bridgeport?

Chapter Six begins with an introduction that describes the importance of incorporating the voices of vulnerable and marginalized groups into climate change adaptation planning. It goes on to consider the challenges associated with incorporating such groups into community-wide planning efforts. In response to this difficulty, it highlights the potential effectiveness of working with specific vulnerable groups in a dedicated adaptation planning process focused on their needs and concerns. It then briefly reviews the results of the research described in Chapters Four and Five as an example of one such dedicated process conducted in collaboration with the elderly community of Bridgeport, Connecticut. The methods section describes the components of the summative evaluation that focused on drawing out key aspects of the process that proved beneficial or challenging. The results and discussion section presents the major themes that resulted from the evaluation and considers their potential transferability to other contexts.

Chapter 6: Enhancing the Resilience of Vulnerable Groups Through Participatory Climate Change Adaptation Planning: Lessons Learned from a Case Study with the Elderly Community of Bridgeport Connecticut

Abstract

Certain groups are more vulnerable to climate change and will likely be more severely affected by predicted impacts. Incorporating the knowledge, perspective, and priorities of these vulnerable groups into adaptation planning can help tailor efforts to effectively reduce their vulnerability. Acquiring this information in community-wide planning processes, however, can prove difficult. As a result, it may be necessary to undertake initial adaptation planning with specific vulnerable groups before bringing this understanding to the larger community. In an effort to inform and promote adaptation planning that engages vulnerable groups, this research presents the results of a case study evaluation of one such adaptation planning project conducted in collaboration with the elderly community of Bridgeport, CT. The evaluation explored attributes contributing to the project's ability to reduce the vulnerability of the elderly community of Bridgeport, as well as key challenges that the project faced. Key themes that emerged from the evaluation include the value of developing a primary partnership with a trusted local organization, fostering an accessible and inclusive process, connecting the subject matter with day-to-day concerns of the participants, using an iterative process to build the capacity of the participants, collaborating with multiple organizations and recognizing their ongoing efforts, and generating initial actions based on the recommendations of participants. The potential transferability of these insights to projects in other contexts and with other vulnerable groups is also explored.

Introduction

Vulnerable groups and climate change adaptation. Different groups within society will be impacted by climate change to varying degrees (IPCC, 2014; Paavola & Adger, 2006). Certain groups are more vulnerable to predicted changes and will likely suffer greater hardships under an altered climate (Figueiredo & Perkins, 2012; IPCC, 2014; Lynn, MacKendrick, & Donoghue, 2011; Morello-Frosch, Pastor, Sadd, & Shonkoff, 2009). This is because a given group's vulnerability is not only a factor of the climate changes to which they are exposed, but is also determined by their sensitivity to those changes, as well as their capacity to adapt (IPCC, 2007). Sensitivity and adaptive capacity depend on a range of economic, social, cultural, institutional, and governance factors (IPCC, 2007).

While vulnerability to climate change varies between regions, countries and communities, it also varies within communities (IPCC, 2014; Lynn et al., 2011; Morello-Frosch et al., 2009; Paavola & Adger, 2006). In many cases, those most vulnerable to the impacts of climate change within a community will belong to groups with specific factors that increase their sensitivity or reduce their adaptive capacity. Examples of groups with a heightened vulnerability include children, the elderly, refugees, minorities, and the poor (Adger, 2001; Cox, Rosenzweig, Solecki, Golberg, & Kinney, 2007; Field, Barros, Stocker, & Dahe, 2012; Macchi et al., 2008; Morello-Frosch et al., 2009; Oxfam, 2009). Each of these groups has specific characteristics that make them especially vulnerable to certain climate changes and, in some contexts, these characteristics are not likely to be shared by the larger communities in which they live.
As these groups face greater risks associated with climate change and have less capacity to protect themselves, it is essential for the communities and societies in which they live to undertake adaptation efforts to promote their safety (Lynn et al., 2011). While larger scale

adaptation efforts, at regional, national, and international levels are needed to set agendas, provide support, and develop initiatives to promote the safety of vulnerable groups, local level efforts are also needed to tailor adaptation responses to address the site specific conditions affecting unique vulnerable groups within communities (Few, Brown, & Tompkins, 2007; Dodman & Mitlin, 2011; Interagency, 2011; Measham et al., 2011; Paavola & Adger, 2006). To develop local level adaptation strategies that effectively safeguard vulnerable groups, it is important for the knowledge and perspectives of these groups to be integrated into the associated planning processes. By including their first-hand knowledge of their own vulnerability, planning efforts can develop better informed strategies based on a more complete understanding of the given context (Jennings, 2009; Lynn et al., 2011). It will also be important for adaptation planning to be responsive to the values and priorities of vulnerable groups in order to develop strategies that meet their needs and are viewed as acceptable by the vulnerable groups themselves (Collins & Ison, 2009; Winsvold, Stokke, Klausen, & Saglie, 2009).

Recent research demonstrates that integrating public participation into local level adaptation planning through a well-facilitated engagement process can effectively integrate local knowledge, values, and priorities (Albert, Zimmermann, Kneiling, & von Haaren, 2012; Cloutier & Joerin, 2012; Dumaru, 2010; Frazier, Wood, & Yarnal, 2010; Gero, Meheux, & Dominey-Howes, 2011). In this way, participatory adaptation planning holds promise for giving voice to vulnerable groups. Simply incorporating vulnerable groups into a larger community-wide process, however, may be insufficient to fully represent their understanding and interests at the planning table.

One reason for this is because community-wide participatory planning can favor common held interests and discourage the interests and concerns held by minority groups within the

community (Kothari, 2001; Mosse, 1995; Nelson & Wright, 1995). As discussed previously, the most vulnerable groups within a community will often face specific challenges in the context of climate change that the rest of the community does not share. Well-intentioned community-wide processes can downplay these groups' special needs and concerns in favor of more commonly agreed upon priorities, thereby failing to address issues of concern to the most vulnerable.

The possibility that community-wide planning will underrepresent the needs of vulnerable groups is exacerbated by the additional potential for participatory planning to replicate existing power structures within communities. Research has shown that participatory planning can result in outcomes that favor those with greater power and privilege to the disadvantage of those with less (Agrawal, 1997; Jennings, 2009). As many vulnerable groups owe their vulnerability, at least in part, to a marginalized status within the community, this tendency will likely place them at a further disadvantage in the participatory process.

Participation can reinforce existing power structures in a variety of ways. Members of a marginalized group might have trouble attending meetings due to financial and time constraints that are often more acutely felt by those in marginalized positions in society (Buchy & Hoverman, 2000; Tompkins & Hurlston, 2012). Even if they are able, marginalized community members might be reluctant to attend or participate. As marginalization is associated with fewer opportunities for formal education, they might not view themselves as having the academic knowledge needed to contribute to adaptation planning that is perceived as highly complex and scientific (Larsen & Gunnarsson-Ostling, 2009). Furthermore, with potentially fewer opportunities for formal education and less experience with civic engagement, marginalized

individuals may be less comfortable speaking in formal public settings (Davis, 1982; Lennie, 1999; Mosse, 1994).

Lastly, other participants and local decision makers might favor ideas expressed by those with more power and privilege (Eriksen et al., 2010; Measham et al., 2011; Reid et al., 2009). Local elites, who have had more opportunities for formal education and experience in formal meetings, may be able to better articulate their agenda in the context of rational argument, scientific data, and interest in the common good (Davis, 1982; Eriksen et al., 2010; Lennie, 1999; Measham et al., 2011; Reid et al., 2009; Sanders, 1997). In comparison, the concerns of marginalized and vulnerable groups can appear anecdotal and belonging to special interests (Kothari, 2001; Mosse, 1995; Nelson & Wright, 1995). With this advantage, and with more connections to others in positions of power, privileged individuals and groups might be able to advance their agenda at the expense of vulnerable groups.

As a result of these factors, the recommendations of community-wide participatory adaptation planning could fail to help the most vulnerable within a community. Unfortunately, these are the very people most in need of assistance. Conducting targeted outreach to vulnerable groups and fostering greater accessibility through the timing, location and support associated with meetings can address this issue in part by encouraging greater participation among vulnerable groups (Cornwall, 2003). Additionally, effective facilitation may be able to moderate the influence of power in the planning process (Buchy & Hoverman, 2000; Cornwall, 2003; Mosse, 1994). Even with careful attention, however, incorporating the voices of vulnerable groups into adaptation planning could still present significant challenges.

One approach, which has been used successfully in the broader field of participatory planning to give voice to vulnerable and marginalized groups, is to hold separate planning

meetings with specific groups to help them develop their understanding and explore their needs (Cornwall, 2003; Figueiredo & Perkins, 2012; Guijt, Kisadha, & Mukasa, 1998; Mosse, 1994). In the context of climate change adaptation planning, holding separate meetings, or a separate process, could present an opportunity for participants from a single vulnerable group to learn about predicted climate changes and the risks they pose, to develop their own understanding of their vulnerability to those risks, and to design their own adaptation recommendations to enhance their resilience. They could then bring these recommendations to the larger community in an effort to advocate for their needs.

The Climate Resilient Seniors project. One example of a planning process that took such an approach was the *Climate Resilient Seniors* project conducted in collaboration with the elderly community of Bridgeport, Connecticut from 2014-2015. The elderly, also referred to as seniors and comprising individuals age 65 and older, have been highlighted in multiple papers and reports as having a greater vulnerability to the impacts of climate change than the general population; and we know from past climate stressors, including heat waves and storms, that they are often disproportionately affected by such events (Frumhoff, McCarthy, Moser, & Wuebbles, 2007; IPCC, 2007; Jonkman, Maaskant, Boyd, & Levitan, 2009; Lynn et al., 2011; Melillo, Richmond, & Yohe, 2014; Morello-Frosch et al., 2009; O'Brien et al., 2008; Oxfam, 2009). Despite the need to develop adaptation strategies to protect this vulnerable group, there has been little research into the elderly's understanding of their own vulnerability to climate change, their concerns about climate change, or their preferred adaptation strategies.

Unfortunately, for many of the reasons listed above, it could be challenging to get an accurate sense of these issues in a community-wide planning process. For example, some elderly individuals may find it difficult to travel to meetings, or may be intimidated by the formal setting

or technical nature of some meetings. These barriers to participation could be even greater among the most vulnerable elderly, including those of minority status, with less formal education, facing financial hardships, suffering from chronic health conditions, or with physical or mental impairments. All of these factors could play a role in limiting the ability of vulnerable elderly individuals to attend and contribute to meetings. Even for elderly individuals who attend and attempt to contribute to community-wide meetings, they may find the issues most important to them, such as vulnerabilities associated with advancing age, are marginalized in comparison to more commonly held priorities.

To overcome these challenges and provide insight into the elderly's vulnerability within the context of one specific elderly community, researchers from Antioch University New England partnered with the city of Bridgeport's Department on Aging to organize the *Climate Resilient Seniors* project. *Climate Resilient Seniors* took place as a series of participatory adaptation planning meetings conducted with Bridgeport's elderly community. The overarching goals of the project were to provide a vehicle for the elderly community to voice their concerns about climate change and develop their own adaptation recommendations, as well as to test a process for incorporating the voices of elderly and other vulnerable groups into larger community-wide planning.

The city of Bridgeport, located along Long Island Sound in southwestern Connecticut, was chosen as the project site for multiple reasons (Figure 1). It has a large and socioeconomically diverse elderly population, with more than 16,000 residents over 65 years of age (US Census Bureau, 2010). Many of the city's elderly face hardships, including low incomes, disabilities, little formal education, and minority status, that heighten their vulnerability to climate change (US Census Bureau, 2012). This population offered the possibility to explore

vulnerability and adaptation perspectives with a range of elderly participants including the very vulnerable. Additionally, predicted changes in multiple climate stressors in the area, including increases in heat waves and extremely hot days, flooding and storms, and air pollution and allergens, served as an effective basis for undertaking significant adaptation planning (Frumhoff et al., 2007; Melillo et al., 2014). Finally, the city's ongoing efforts to address climate change offered the potential to bring the elderly participants' recommendations to the greater community in an attempt to integrate them with those larger efforts (City of Bridgeport, 2012).

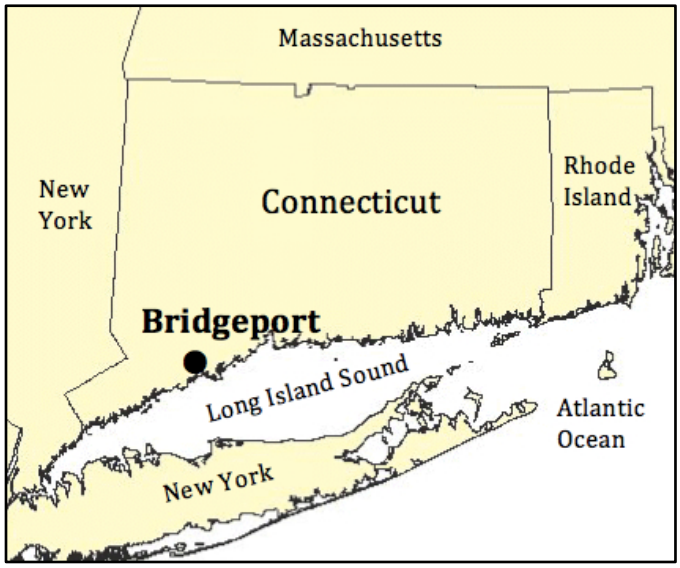

Figure 1. Map showing the location of Bridgeport, Connecticut. Base map prepared by the State of Connecticut Department of Energy and Environmental Protection (2013) and is in the public domain.

The project meetings were open to any members of elderly community of Bridgeport wishing to attend and were strategically promoted throughout the city by the Department on Aging in an effort to attract a diverse representation of the elderly community. The meetings were held at the main senior center in Bridgeport, as it is centrally located, has good public transportation, and is a comfortable location for elderly. To further enhance accessibility, meetings were held late in the morning on days when there were few conflicting events.

During the meetings, participants worked through the initial steps of an adaptation planning process based on a model developed by the NRC (2010). These steps were to:

1. Determine the relevant climate stressors.
2. Gather data on the vulnerability of the elderly community to those stressors.
3. Analyze the vulnerability data and determine the most significant causes of vulnerability to address.
4. Develop and prioritize climate change adaptation plans.
5. Share adaptation plans with the municipality to look for opportunities for collaboration and implementation.

In an effort to highlight the perspectives of the elderly throughout the planning process, the project was guided by the spirit and principles of community-based action research. In particular, a special emphasis was placed on cooperation and equity, examining issues in context, incorporating multiple ways of knowing, and fostering action to address issues of concern to the participants (Strand, Cutforth, Stoecker, Marullo, & Donohue, 2003; Stringer, 2007).

In the first two vulnerability assessment meetings, participants began by discussing their current vulnerability to climate stressors and then considered the implications of climate change. They highlighted a variety of personal characteristics, including economic limitations, social isolation, chronic health conditions, as well as physical and mental impairments that are associated with advancing age and can contribute to vulnerability. They also described a variety of contextual factors that could exacerbate or mitigate these personal characteristics. Also, they described how climate change could easily overwhelm elderly individuals' limited adaptive capacity, highlighting the need for effective community support structures to safeguard the elderly from the impacts of climate change.

Based on this understanding, the elderly participants collaborated with the lead researcher to design a Likert scale survey to allow the broader elderly community to rank their level of concern over various factors contributing to their vulnerability. The surveys were distributed

through municipal, community, and faith-based organization in a targeted effort to reach a diverse representation of Bridgeport's elderly, including the most vulnerable among them. Through the survey, 164 respondents indicated a broad range of concern over issues associated with preparing for, coping with, and recovering from climate related stressors.

Over the course of two additional adaptation planning meetings, participants used the results of the survey as a basis for developing and prioritizing adaptation strategies to enhance their resilience. By the conclusion of the process, participants had developed six adaptation goals and seven specific adaptation recommendations focusing on encouraging preparedness, promoting warning mechanisms, increasing transportation resources, improving shelters, and enhancing the accessibility of resources to aid in coping and recovery. The prioritization exercise demonstrated general support for the recommendations, with participants indicating their belief that all recommendations were likely to be effective and feasible to implement.

A summative evaluation showed that the project achieved multiple benefits. Participants indicated that the final adaptation recommendations reflected the needs and concerns of the elderly community of Bridgeport and would help make them safer. Furthermore, the project has led to action: The city of Bridgeport is already acting on multiple recommendations and there are plans to continue implementing additional suggestions. Participants indicated that the project increased their awareness of climate risks, raised their knowledge about how to protect themselves, and increased their ability to advocate for their needs. Additionally, city staff indicated that the project increased their awareness of the risks climate change poses to the elderly and increased communication among their agencies on these issues.

The project's approach and results are described in greater detail in Rhoades, Gruber, and Horton (2016a) and Rhoades, Gruber, and Horton (2016b). This paper presents the results of a

case study evaluation of the project that endeavored to draw insights from the process itself with the hopes that such knowledge might inform future participatory planning efforts with elderly communities and other vulnerable groups. In particular, this evaluation focused on identifying positive attributes of the process and key challenges that the process faced.

Methods

To gain insight into working with the elderly on a participatory adaptation planning process, a case study evaluation was conducted at the close of the *Climate Resilient Seniors* project. The evaluation focused on two primary questions:

- What aspects of the project contributed to any beneficial outcomes?
- What were the primary challenges that made the project difficult and how were they addressed?

Multiple sources of qualitative data were used to investigate these questions. This was done both to triangulate the data gathered and to provide multiple perspectives on the project process and outcomes (Davidson, 2005; Yin, 2009).

As part of the evaluation, elderly attendees participated in a semi-structured focus group interview (Patton, 1987). In addition to the two primary questions, additional probing questions were used to dig deeper into key topics. During the interviews, a concerted effort was made to hear from a broad range of the participating elders.

In addition, semi-structured interviews were conducted with city staff who were involved in the process from the Department on Aging and the Office of Emergency Management and Homeland Security (Patton, 1987). Again, the interviews focused on factors that contributed to the project's beneficial outcomes and challenges, but interviewees responded from their perspective and the perspective of their agency.

Open coding was used to analyze both sets of interview data (Strauss & Corbin, 1998). This process, which involves the repeated rereading of the material in an iterative process of categorization and revision around important topics, was chosen to highlight the perspectives of the interviewees. In an effort to capture a range of viewpoints, additional attention was paid to divergent perspectives and minority views among the groups (Stringer, 2007).

To triangulate this data, the lead researcher conducted participant observation throughout the project (Yin, 2009). Observation was conducted during project planning sessions, meetings, and additional conversations with elderly participants, city staff, and other project partners. Particular attention was paid to beneficial approaches, key challenges that presented difficulties for the project, and approaches to overcome those challenges.

Based on interview themes and participant observations, findings were organized into overarching categories focusing on the primary research questions. In this, an effort was made to both highlight perspectives held in common by the various participants and partners as well as to preserve divergent perspectives. These categories and their related descriptions were then reviewed by the case study participants, including both the elderly project participants and the participating city staff, and their feedback was incorporated into a revised draft.

As this evaluation consists only of a single case study, its results cannot be considered generalizable to other adaptation planning projects. Focusing on a single case, however, allowed the research questions to be explored in great detail and within their context to produce results that more fully reflect the nuanced interrelationships at play (Stringer, 2007; Yin, 2009). Depending on context, aspects of the results may be transferable to other adaptation planning projects conducted in collaboration with elderly or other vulnerable groups (Guba & Lincoln, 1985). To enable other researchers and practitioners to assess the potential transferability, I have

endeavored to describe the project context, process, and findings in sufficient detail to facilitate close comparison. Rather than a definitive list of best practices, however, the following findings can be best understood as the collective observations of a single process put forward in an effort to inform and encourage additional participatory adaptation planning conducted in partnership with vulnerable groups.

Results and Discussion

Ten major themes emerged incorporating both the major challenges faced by the project as well as approaches that contributed to the beneficial outcomes of the project (Table 1).

Table 1. *Themes from the Climate Resilient Seniors project incorporating the major challenges faced by the project and approaches that contributed to beneficial outcomes.*

1. Develop a primary partnership with a local organization trusted by the target participants.
2. Host meetings in locations and times accessible for target participants.
3. Connect issues with the day-to-day concerns of participants.
4. Use an iterative process.
5. Accommodate the unique needs of the participants.
6. Recognize the diversity within the participant community and foster inclusivity.
7. Collaborate with multiple organizations and recognize their going efforts.
8. Consult with and produce information that is useful to local support organizations.
9. Balance the needs of the planning process with the time constraints of the participants.
10. Generate initial action based on recommendations.

Each of these themes will be explored in turn, highlighting the perspectives of the elderly and city staff participants and the beneficial approaches and challenges associated with each. As one goal of this paper is to encourage and support additional efforts to incorporate vulnerable and marginalized groups in participatory climate change adaptation planning, the potential applicability of the each of these themes is also an important consideration. To address this consideration, a brief discussion of each theme's potential transferability to other contexts will be included at the end of the description of that theme.

Develop a primary partnership with a local organization trusted by the target participants. "You need to have a good rapport with the seniors," suggested a Department on Aging staff member. Elderly participants and staff from the Department on Aging commented that it was important to have the Department on Aging as a key partner helping lead the project because of their good rapport with, and the trust of, the elderly community. The Department on Aging had the knowledge of when, where and how to arrange the meetings. They had the ongoing relationship and contact with the elderly community to invite them to the meetings and get them to participate. As one elderly participant commented, "I trust the senior center, so when they asked me to come, I came." They also had the needed experience working with the elderly to help facilitate the meetings. Their expertise was especially useful in encouraging the participation of the most vulnerable elders, who might have had trouble contributing during the meetings without the support of the Department on Aging staff. One elderly participant touched on this sentiment, sharing, "It was nice to have the staff there to help explain the questions to us and work with us during the meetings."

It should be noted that the choice of a specific primary partner could have potentially biased or limited access to various subgroups within the elderly community. To avoid this, the senior center was specifically chosen because they were broadly engaged with a diverse range of the elderly in Bridgeport, including vulnerable and marginalized segments of that community. To further ensure that a diverse representation of Bridgeport's elderly were included in the process, additional local organizations were also engaged in conducting outreach. Additionally, the demographic backgrounds of the participants were tracked to identify if any subgroups were underrepresented and in need of additional outreach or accommodation to encourage their participation.

Potential transferability. As marginalization is an important factor contributing to vulnerability, many vulnerable groups may occupy marginal positions in society. As such, it is possible that a range of vulnerable groups could be reluctant to trust and collaborate with an outside organization that they have had no experience with. Including a local organization on the project that has a history of working with the target participants it one way to help gain their trust and participation. Local organizations would also likely have first hand knowledge about working with that group that would be helpful in designing and facilitating the project.

As was the case in Bridgeport, project facilitators should keep in mind that their choice of partner organizations could influence their access to the target community. There may be some subgroups with closer ties to the partner organization whose presence within the community and associated agenda may be appear amplified, while other subgroups might go unnoticed due to their lack of association with the partner organization. To reduce the possibility of such a skewed representation, facilitators should consider the potential partner organizations' relationships to various subgroups within the community and seek to partner with an organization that has diverse connections, including relationships with the most vulnerable and marginalized. In addition, it may be helpful to collaborate with additional locally engaged organizations that may have better access to certain subgroups. It could also be advantageous to reach out to any potentially excluded segments of the target community to encourage their participation. Tracking the demographic make up of the participants can help facilitators identify if any subgroups are underrepresented. Finally, in selecting a partner organization, facilitators should also consider the agenda of the partner organization in the community and how that might influence the ability of participants to freely engage with and shape the planning process.

Host meetings in locations and times accessible for target participants. An added benefit of partnering with the Department on Aging was that it allowed the project to hold the participatory meetings at their main senior center. As discussed earlier, travel and accessibility can present barriers that limit elderly participation, but this location had many advantages that moderated these challenges. The senior center was centrally located in the city to encourage participation from elderly individuals from diverse neighborhoods. It was also accessible via public transportation, making it reachable for elderly who were unable to drive. The location was also familiar and comfortable for elderly participants.

Furthermore, many elderly individuals were often travelling to and using the senior center for other reasons. This had benefits for the participants as well as the project. Participants were able to combine their trip to attend a meeting with other activities at the senior center, saving them additional travel time. Additionally, the project was able to gain the attendance of elderly individuals who were already at the center for other activities, but might not have traveled exclusively for a meeting. Hosting meetings at the senior center also allowed the project to combine meetings with free senior lunches, which helped encourage participation and also partially compensated participants for the time and effort they contributed to the meetings. A member of the Department on Aging staff summed this up, concluding "the location was perfect."

In addition to fostering accessibility through the location of the meetings, the project also encouraged accessibility through the timing of the meetings. Meetings were held at late morning, which fit well with most participants' schedules and also led up conveniently to the lunch hour. Meetings were also held on days when there were few conflicting events for participants.

The importance of accessibility was highlighted at the start of the project's third meeting. Some of the meeting participants who had driven to the meeting were concerned about a change in parking policy around the center. Previously, individuals with a handicapped tag were allowed to park near the senior center for free. Participants had heard that this would no longer be the case and that they would have to pay at meters to avoid a ticket. The participants were concerned about the additional cost of paying for parking and also about the prospect of receiving a ticket. This issue was so pressing for participants, they had to be reassured that the parking policy had not changed before the meeting could continue.

Potential transferability. Vulnerability is associated with multiple factors that could make it difficult for a range of vulnerable groups to attend meetings. This challenge could be as significant for other vulnerable groups as it was for the elderly community in this research. For example, they may not have the flexibility in their schedule to attend meetings at certain times of day or they may not be able to afford to travel to certain locations. Although the specific barriers to participation may be different between groups, and so would require different solutions, issues of accessibility will likely be an important consideration when working with a range of vulnerable groups.

Connect issues with the day-to-day concerns of participants. One of the potential challenges that the project faced was engaging the elderly participants in an issue that could be viewed as a problem for coming generations and irrelevant to their concerns. Such thinking would be especially understandable among the more disadvantaged members of the elderly community who were likely to be troubled by a host of additional financial, social, and health issues vying for their concern. Department on Aging staff commented, "It can be hard to get seniors to care about this kind of stuff, they have a lot of pressing concerns and don't necessarily

want to have to think about something else." The project took a few approaches to address this challenge. First, the focus of the project was presented as larger than climate change. Rather, the project was presented as focused on extreme weather and the safety and well-being of the elderly community. As one elderly participant noted, "Weather is a big deal to seniors." This interest was enhanced by two agenda setting events that highlighted the region's vulnerability to extreme weather: Superstorm Sandy in 2012 and an unusual October snowstorm in 2011. As a staff member of the Department on Aging indicated, "It was good timing for the project…with strong interest among seniors and the city in extreme weather."

In an effort to further connect the project with the elderly's day-to-day concerns, we began the project by focusing most heavily on historical climate trends and their impact on the participants. This focus on extreme weather, historical trends, and personal impacts allowed participants to directly connect the project with their own lived experiences and individual concerns, while simultaneously allowing the project to avoid getting bogged down in ongoing debate over the nature of climate change. Once participants realized that the project would be responsive to their interests and concerns, they were more eager to engage with the material. With this foundation, the focus shifted from historical climate trends to a more thorough examination of current climate predictions.

During presentations and in project materials, an effort was made to present the relevant scientific information clearly and succinctly, without overwhelming the participants with data and technical complexity. Presentations of scientific information were kept to limited length and the focus of the project was continually brought back to the perspectives and experience of the participants. This allowed participants to develop their own understanding of the issues and focus on their areas of interest within the subject.

As the project continued, the participants were able to shape every stage of its evolution to ensure that it was responsive to their interests. Survey questions were developed with their oversight and based on their own priorities. Adaptation strategies were developed by participants to focus on their own goals for the adaptation process. As a result, participants remained engaged throughout the project process and, at the end, indicated their strong agreement that the project reflected the needs and concerns of the elderly community of Bridgeport.

Potential transferability. As with the elderly, other vulnerable groups are likely to face a range of challenges and hardships that, in addition to contributing to their vulnerability, also compete for their attention. While the specific challenges may be different according to each vulnerable group, finding ways to connect the impacts of climate change with the day-to-day concerns of the participants may help engage them in the project and expand the potential impact of the project.

Use an iterative process. An important aspect of the project that helped facilitate beneficial outcomes, and which has been touched upon in previous sections, was the use of an iterative process. Following the brief initial presentation on climate stressors, the project began with questions to help participants explore the challenges that climate change posed for them. This understanding was built one step at a time. First, participants looked at their current challenges and then explored the potential impacts of climate change. Based on this understanding, they designed a survey to allow participants to rank their level of concern over a variety of factors related to their vulnerability. Then, based on the survey results, participants developed a set of overarching goals for the adaptation planning process and used these goals to develop specific adaptation recommendations. These recommendations were then prioritized by

the group. Each of these stages also included a process of review, comment, and revision to allow participants to further develop and refine the results of that stage. This iterative process allowed participants, both as individuals and as a group, to develop their understanding of the issues and potential solutions and then utilize that understanding in the following steps.

An important aspect of the process that helped allow for this iterative process to unfold was resisting the urge to jump to solutions. Following the initial presentation at the first meeting, participants began proposing potential adaptive recommendations. Throughout the initial stages of the project, however, the lead facilitator helped the group resist the impulse to immediately begin developing solutions. At times, this patience was challenging for the group, as expressed by one participant, who halfway through the first meeting exclaimed his assessment that "this is all a waste of time, the only important thing is to make sure that seniors know where the shelters are located." Any potential adaptation recommendations, such as this, were noted, but then the group was encouraged to continue to develop their understanding of the problem itself before moving on to focus on solutions. This restraint was vital to let the iterative process unfold, and to ensure that the participants had a fully developed understanding of the challenge they were trying to solve. With this more developed understanding, participants were then able to devise a comprehensive and well targeted set of adaptation recommendations.

Potential transferability. In some cases, vulnerable groups or their members may not have a detailed understanding of their vulnerability to climate change. The politicized and highly scientific manner in which climate change is often portrayed in places like the United States could cause vulnerable groups to view it as unrelated to their more pressing day-to-day concerns. As a result, it is understandable that members of a vulnerable group might choose to focus on the many other concerns vying for their attention and would have not fully considered

the potential impacts climate change may have upon their well-being. In other cases, vulnerable or marginalized groups may simply lack access to relevant climate data or be unable to interpret its significance in the context of their day-to-day lives. As was the case in Bridgeport, an iterative process is one way to help provide this information, build the group's understanding, and then undertake adaptation planning. Even if some members of the group have studied and considered climate change in depth, others may have less of an understanding of the subject and an iterative process allows all the members of the group to build their understanding together.

Accommodate the unique needs of the participants. As mentioned earlier, numerous barriers can make it difficult for elderly individuals to participate in formal processes. The *Climate Resilient Seniors* project employed multiple approaches to accommodate the unique needs of the elderly community and enhance their ability to participate. As the second recommendation suggested, hosting meetings at the senior center during convenient times was one way to make participation easier for the elderly community. In addition, project materials, including agendas and surveys, were printed in large font with clear language to allow elderly individuals with visual impairments, little formal education, or cognitive impairments to comprehend and contribute to various aspects of the project. Presentations to the participants were also given in slow clear speech to ensure that elderly individuals with sensory or cognitive impairments could comprehend the material being covered. As mentioned under the recommendation to connect the issues with the day-to-day concerns of participants, presentations and materials also strove to provide scientific information clearly and succinctly without overwhelming participants with their complexity or duration. Finally, during sessions of the meetings where participants reviewed project materials, discussed various issues in working groups, or tested survey instruments, the lead researcher and staff from the Department on Aging

regularly checked in with the participants to answer questions and help them work through the task at hand as needed.

Potential transferability. The specific needs of different vulnerable groups will vary. Vulnerability, however, is rooted in multiple factors that can increase sensitivity and decrease adaptive capacity, and many of these same factors could also pose barriers that limit vulnerable groups' ability to participate in planning processes. For example, while the elderly participants faced challenges associated with advancing age, participants from other groups may not speak English, may not be comfortable with formal participatory processes, may be illiterate, or may face significant financial challenges. Each of these challenges will require different approaches, but will need to be addressed to more fully include the participants. Therefore, in working with other vulnerable groups, it will be important to consider what potential challenges might limit their ability to participate in the process and take steps to accommodate those needs.

Recognize the diversity within the participant community and foster inclusivity. While the above measures were taken to accommodate challenges generally associated with advancing age, it is important to note that there is great diversity within the elderly population. This diversity is composed of many factors including variations in education, health, economic security, culture, ethnicity, disability, and frailty. The interplay of these factors can influence elderly community members' abilities to participate in the project as well as their interest to do so.

This range of interest and ability, and its implications in terms of project engagement, became evident during the first meeting. After a brief presentation on the main climate stressors likely to affect the elderly community, participants broke up into groups to discuss the stressor of greatest concern to them. While the instructions for the discussions were clear and some of the

groups dove into productive conversation immediately, it was evident that some of the groups were having trouble getting started and not all of the participants were comfortable engaging. This posed a serious challenge for the project early on. While participants were free to shape the direction of the project in response to their interests, if only a subset of the participants felt comfortable contributing, then the project would be a misrepresentative reflection of their priorities.

In response to this challenge, the project utilized four approaches to encourage and represent the participation of a diverse range of elderly community members. First, the lead researcher and staff from the Department on Aging went around and worked with groups and individuals during meetings to help answer questions and encourage participation. Second, connecting the issues with participants' day-to-day concerns allowed diverse participants to focus their engagement on personally relevant topics. Third, multiple opportunities for engagement were built into the project as part of the iterative process. For those elders comfortable and interested in participating in discussion-based sessions, they were able to engage in this way. Elders who were unable or uninterested in this type of participation were able to share their perspective and shape the process through multiple surveys, comment periods, and informal feedback mechanisms, some of which could be completed from their homes without traveling to the senior center or attending a meeting. Fourth, at each stage of data synthesis and reporting, including the final project reports, the diversity of participant responses was highlighted and no minority perspectives were discounted. The combination of these steps helped facilitate a process that inclusively represented the perspectives of a range of elderly individuals, including the most infirm and marginalized. This is especially important as, without

these measures, the individuals who are in greatest need of assistance in the context of climate change adaptation, could have been underrepresented in the project.

Potential transferability. Just as with the elderly community of Bridgeport, there will be diversity within any vulnerable group. This diversity will inform group members' relative vulnerability to climate change and also their individual needs, concerns, and preferred manner of contributing to the project. In working with any vulnerable group, it will be important to gain a strong understanding of the diversity within that group and take steps to foster an inclusive and equitable process.

Collaborate with multiple organizations and recognize their ongoing efforts. During the project, multiple organizations were engaged as partners. City staff from the Department on Aging, the Office of Emergency Management and Homeland Security, and the Office of Sustainability attended meetings, answered questions, reviewed materials, and gave feedback and guidance throughout the process. Community and faith based groups also assisted by sharing project information and distributing project surveys. These organizations included St. Vincent's Medical Center, the Stafford Visiting Nurses Association, CW Resources Meals on Wheels program, the Bridgeport YMCA.

In many cases these local partners were already involved in efforts to promote the wellbeing of the elderly and some partners were already involved in efforts to prepare for climate change. In particular, the city's Department on Aging and Office of Emergency Management and Homeland Security had prior and ongoing efforts in both regards. Additionally, the subject of climate preparedness was an important focus for the Mayor. A concerted effort was made to learn about, acknowledge, and incorporate these efforts into the planning process.

This approach had multiple benefits. First, acknowledging the hard work that partners had already done helped foster a positive working relationship between the project and the participating partners. Rather than viewing the project as an incursion onto their territory, partner organizations saw the project as providing assistance to increase the effectiveness of their efforts and were therefore more willing to contribute. Second, having representatives from partner organizations at the meetings helped increase elderly participants' awareness of the resources available to keep them safe. As one elderly participant noted, "I was unaware of a lot of the city's programs to help seniors, it was great to have them there to fill in the blanks." Third, the ongoing efforts of project partners offered starting points for designing adaptation strategies. Rather than beginning from scratch, when possible, elderly participants could tailor existing efforts to more effectively serve the needs of the elderly community. Utilizing and building on existing programs helped improve the efficiency, effectiveness, and likelihood of implementation of the recommended adaptation strategies.

Additionally, bringing in partner organizations raised awareness among those organizations about the risks that climate change can pose to the elderly residents of their community. Staff from the Department on Aging and the Office of Emergency Management and Homeland Security both noted such an impact. Furthermore, by engaging these partner groups in the planning process, the project developed potential allies who might be able to aid in the implementation phase. For example, the Office of Emergency Management and Homeland Security has the expertise to develop the recommended emergency preparedness trainings and informational materials while the Department on Aging can help promote and host the trainings. Additional partners, such as the Visiting Nurses Association and the Meals on Wheels program, could be brought in to help distribute the emergency preparedness booklets and magnets.

As this last example illustrates, uniting these multiple partners also has the potential to increase communication and collaboration among them to address the vulnerability of the elderly to climate change. Again, interviewees from the Department on Aging and the Office of Emergency Management and Homeland Security both indicated that they were in closer communication regarding the elderly and climate change as a result of the project. As each of the project partners provides different and important support services to the elderly community of Bridgeport, such increased awareness and expanded communication and collaboration could be instrumental in providing the coordinated support elders need to be safe in a time of climate change.

Finally, a staff member from the Department of Emergency Management and Homeland Security noted that their involvement in the project also served to improve their relationship with the elderly community. As he explained, "It builds trust between seniors and the city if the city can be present and responsive to their concerns, even if it can't be solved immediately, we can work jointly to develop a solution." Having the trust and engagement of the elderly community will be an important resource for the city in their effort to help the elderly prepare for climate change.

It should be noted that, while the city was very involved in the project, the participation of the other community organizations was more tangential to the effort. Having these groups involved was certainly helpful for the above reasons, but the project could have benefitted from more fully integrating their involvement. To this end, future projects could include representatives from community organizations like these on an advisory committee, invite them to project meetings, and solicit their guidance at various project stages. These groups could also be enlisted to recruit project participants and host planning meetings. Additionally, local

universities or colleges with relevant academic departments, such as gerontology, nursing, public health, or emergency management could have been included in the effort. As demonstrated in other participatory planning projects, such a partnership can benefit the project by tapping the expertise and resources of the institutions of higher education while providing meaningful community engagement opportunities for faculty and students (Gruber et al., 2015). While developing these stronger associations might be difficult due to the busy schedules of the potential partners and would certainly require additional time and effort, the benefits could be well worth the effort.

Potential transferability. As was the case with the elderly in this study, some vulnerable groups may be served by a range of municipal and community based organizations. When this is the case, similar advantages as were attained in this study could be gained by collaborating with these groups. Furthermore, when measures are already in place that help to protect a vulnerable group from climate change, it would certainly benefit a participatory planning effort to recognize those efforts and seek to build off of or tailor those efforts as needed to improve their effectiveness.

Consult with and produce information that is useful to local support organizations. While it was important that the project reflect the needs and concerns of the elderly participants, it was also important that the results of the project be of practical use to the support organizations that work to keep Bridgeport's elderly community safe. City staff from the Department on Aging indicated that the quantitative data collected during the surveys, and also as part of the demographic tracking of participants, was particularly helpful. As a staff member explained, presenting raw data and percentages about who was participating in the project and their level of concern over different factors was "definitely beneficial because everyone wants to see

percentage and what population its helping out as well." Tracking project participants with demographic surveys also helped ensure that the process was diverse and inclusive of the full socioeconomic range of Bridgeport's elderly community.

Staff from the Office of Emergency Management and Homeland Security also commented that they appreciated the level of specificity in the adaptation recommendations that resulted from the project. "We have done emergency preparedness trainings for the seniors in the past" he explained, "but these recommendations are great because they specify exactly what seniors would like to have included in those trainings." Representatives from both city agencies indicated that the specificity, clarity, and well documented nature of the project results increased their likelihood of implementation.

Having representatives from these city agencies present at the meetings also helped ensure that the project produced information that was relevant to their efforts. Their presence helped accomplish this in part by ensuring that participants were aware of the city's current initiatives. It also allowed city staff to ask guiding questions of the group to help generate needed information.

One aspect of the project that could be improved upon in the future efforts would be to consult directly with partner organizations on the kind of information that would be most helpful at the outset. While there was an initial pre-project planning meeting with representatives from relevant city agencies to help guide the planning process, it would have been beneficial to dedicate a more significant portion of the meeting to this end. This type of information could help ensure that the project produces results that help inform and shape the practical efforts of elderly support organizations.

Potential transferability. Regardless of the specific vulnerable group participating in a project, it will be important for that project to produce results that can contribute to practical efforts to protect them from climate change. This means that the results will need to be useful to relevant government and community partners who can play a role in implementing the final recommendations. To help ensure that this is the case, it may be helpful to consult with these groups at the outset of the project and to maintain their involvement for the duration of the process.

Balance the needs of the planning process with the time constraints of the participants. Throughout the project, there was a constant tension between the amount of time needed for a meaningful participatory process and the time constraints of the participants. Allowing the participants to learn about trends associated with climate stressors, discuss their vulnerability, develop and utilize survey instruments, craft adaptation strategies, and review and revise the output of each step took considerable time. Elderly project participants had many competing demands for their time and it was difficult to maintain their engagement for the duration of the project. As one participant explained, "I am involved in a lot of activities at the center, so sometimes meetings would conflict with something else I wanted to do." Participating city staff also had many competing demands on their time.

In order to allow participants to engage with the process in a meaningful way, while limiting the demands placed on their time, the lead researcher tried to make the process as efficient as possible. Presentations were limited in length to dedicate the majority of time to participant discussions during the meetings. Between meetings, the lead researcher summarized the output from the last meeting and provided this information in a clean format for participants to review at the start the following meeting. Clear agendas and strict time management also

helped ensure that all important project steps needing attention were covered at each meeting. To increase productivity at the meetings, occasionally participants would break out into multiple groups to focus on different topics and then report out their results to the rest of the group and solicit their additional feedback. The lead researcher and staff from the Department on Aging also worked with participants in small groups and one on one to help them grasp and contribute to meeting topics in a more efficient manner. Finally, if any participants had additional comments that they did not have time to contribute during a meeting, they had the additional option of providing written comments on prepared comment sheets which were then incorporated into the meeting results and reviewed at the following meeting. Despite of all of these measures, the project still required a significant commitment on the part of participants and their effort deserves recognition. As a staff member from the Department on Aging noted, to make a project like this work, "You need a strong core group that sees the importance of the project and is dedicated."

Potential transferability. As mentioned earlier, members of a range of vulnerable groups may face numerous challenges that compete for their attention and make dedicating time to a adaptation planning difficult. Staff working for municipal and community partners are also likely to have little expendable time and energy to devote. Therefore, in a variety of contexts, it may be helpful for project facilitators to devise strategies to use participants' time as efficiently as possible, balancing the needs of the process with the time constraints of those involved.

Generate initial action based on recommendations. As a result of the actionable recommendations generated by the project and the inclusive nature of the project process, which involved both the elderly community and relevant support organizations, there was considerable interest on the part of the participating city agencies to begin implementing the

recommendations. To ensure that this interest in taking action was brought to fruition, a first step at implementation was incorporated into the last meeting. At the close of the final project meeting, staff from the Office of Emergency Management and Homeland Security provided an emergency preparedness training for the participants. This was one of the project's high priority recommendations, and the training directly reflected the participants' input. As one participant noted, "It was great to have the training and great to see the city acting on our ideas." In this way, the training provided a satisfying close to the planning process for participants and also helped focus the group's attention on the implementation phase of the project. This initial success has raised the group's interest in continuing to implement additional suggestions. As a staff member of the Department on Aging shared, "We are not going to let this fade away."

Potential transferability. Crossing the bridge from planning to action could be a potential challenge for any project. Helping to start this momentum by generating initial action based on the project recommendations could help foster additional effort in a variety of contexts.

Conclusion

These themes highlight many of the factors that helped contribute to the project's successes and key challenges the project faced, as well as some potential improvements that might have benefitted the project. While this study is limited to one community, and so the results cannot be considered generalizable, they may be transferable to some other contexts. In this way, we hope that these insights might be of some use in working with other vulnerable groups to protect them from the impacts of climate change.

These themes will likely be most applicable in working with other elderly groups, as these groups will have the greatest similarity to the participants of this study. However, as vulnerability derives in large part from a variety of factors that put specific groups at greater risk

to climate change, it is reasonable to assume that a range of vulnerable groups may share certain common traits. Factors such as minority status, marginalization, little formal education, and lack of financial resources can all contribute to vulnerability and may be shared in common by multiple vulnerable groups. In addition to contributing to vulnerability, these factors can also pose challenges for engaging vulnerable groups in participatory processes. Insofar as the underlying factors contributing to vulnerability bear similarity across certain vulnerable groups, so might the themes be applicable to a range of contexts.

The potential transferability of these themes is further supported by their similarity to other recommended best practices developed within the broader field of participation. For example, in the context of participatory environmental management, Reed (2008) has highlighted best practices including understanding the diversity among potential stakeholders and fostering an inclusive process, emphasizing equity among participants, and choosing methods and levels of engagement that accommodate the needs of the participants. And in the context of participatory climate change adaptation planning, Dodman and Mitlin (2011) also recommend connecting climate change with the day-to-day concerns of participants, representing and addressing the heterogeneous needs of participants, and engaging multiple partners in planning projects at a range of scales.

While these themes are potentially transferable to other vulnerable groups and contexts, project facilitators will need to be responsive to the specific nature of the vulnerable group they are working with and the context of their vulnerability. This will require extensive pre-project planning and an ongoing sensitivity to the unfolding needs of the participants during the process. As a result, the specific approaches employed will vary from one project to the next. Conducting additional case study evaluations of additional participatory climate change adaptation planning

projects with vulnerable groups in a variety of settings can help further our understanding of effective project design and facilitation within the context of community specific factors.

Despite the inevitable differences between projects, these themes may be worth considering at the outset of a project as a partial checklist of issues to consider. In this capacity, they may help project planners foster a representative process which equitably gives voice to the needs and concerns of vulnerable groups and also further engages the larger communities in which they live to undertake substantive efforts to reduce their vulnerability to climate change. By thoughtfully and committedly undertaking additional participatory adaptation planning projects in partnership with the most vulnerable groups within our society, we can build the awareness, knowledge, coordination, and momentum needed to prevent the impacts of climate change from disproportionately burdening those least capable of withstanding those effects.

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Chapter 7: Conclusion

Recent reports highlight, and this research reinforces, the potentially grave risks that climate change could pose for the elderly. The elderly's first hand knowledge of their own relationship to climate related stressors will be of great value in understanding their vulnerability to climate change. In addition, their insight into approaches that could keep them safe will be very helpful in designing effective adaptation strategies to enhance their resilience.

This research has demonstrated one approach for drawing out this knowledge and understanding and bringing it to the larger community. Through a participatory climate change adaptation planning process, members of the elderly community of Bridgeport, Connecticut, drew on their own experience as well as relevant climate science to characterize their vulnerability to climate change and prioritize their concerns. Based on this detailed understanding, they developed adaptation goals and recommendations. Within their adaptation plan, they put forward strategies that provide multiple benefits, build on existing efforts, develop overlapping approaches to enhance resilience, and integrate the efforts of multiple partners. The specific recommendations were then prioritized based on their potential impact reducing risk associated with climate related stressors among the elderly and their potential feasibility of implementation.

A summative evaluation conducted at the conclusion of the project demonstrates the value of this participatory approach. Elderly participants indicated that the strategies developed reflect the concerns and needs of the elderly community and will also help make them safer. They also indicated that the project increased their awareness of how changes in extreme weather will affect them and their knowledge about how to protect themselves. Elderly participants also agreed that the project enhanced their ability to advocate for their needs in the context of extreme

weather. In addition, city staff from agencies that were involved in the process reported that their involvement raised their awareness of issues associated with the elderly and climate change and also increased their communication with other relevant agencies and organizations regarding these issues. The combination of these benefits will be of great value in addressing the serious risks facing the elderly in the context of climate change.

In the hopes of supporting additional efforts to involve vulnerable groups in climate change adaptation planning, the evaluation also endeavored to draw out beneficial characteristics and key challenges of the process. Ten themes emerged that highlight the most prominent lessons learned from the project:

- Develop a primary partnership with a local organization trusted by the target participants.
- Host meetings in locations and times accessible for target participants.
- Connect issues with the day-to-day concerns of participants.
- Use an iterative process.
- Accommodate the unique needs of the participants.
- Recognize the diversity within the participant community and foster inclusivity.
- Collaborate with multiple organizations and recognize their going efforts.
- Consult with and produce information that is useful to local support organizations.
- Balance the needs of the planning process with the time constraints of the participants.
- Generate initial action based on recommendations.

As researchers and practitioners work to safeguard other elderly communities, directly incorporating those groups into the planning process can help foster adaptation that addresses their specific concerns and needs. While this research focused on the elderly, similar benefits may be gained from inclusive planning with other groups that have been identified as having a heightened vulnerability to climate change, including refugees, children, minorities, and the poor. To prevent the concerns of a vulnerable and potentially marginalized group from being overlooked in the adaptation process, committing time and resources to a dedicated planning process with that specific group can help them develop their understanding of their own

vulnerability as well as their adaptation priorities. The results of this process can then be utilized by the vulnerable group directly and be brought to the larger community in an effort to advocate for their needs at the municipal scale.

Through the resulting plans, as well as the capacity building associated with the process itself, such efforts offer the potential to effectively enhance the resilience of those groups who are most vulnerable to the impacts of climate change. Dedicated participatory planning processes conducted in collaboration with vulnerable groups also present an opportunity to deepen our understanding of vulnerability, resilience, and effective adaptation strategies in relation to those groups in a variety of contexts. By actively pursuing collaborative and inclusive efforts to improve our understanding and protect these vulnerable groups, we can endeavor to protect the most vulnerable among us from the impacts of climate change.

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Appendices

Appendix A: Final project report for project participants and partners

Climate Resilient Seniors
Final Project Report

2014-2015

prepared by
Jason L. Rhoades
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February 2016

Executive Summary

Predicted climate changes, including increases in extreme heat, flooding and storms, and air pollution, pose serious risks for the elderly community of Bridgeport, Connecticut. Their first hand knowledge and experience with these climate related stressors are valuable sources of information in understanding their vulnerability to climate change and developing effective adaptation strategies. In an effort to draw out this understanding, Antioch University New England partnered with the Bridgeport Department on Aging to facilitate the *Climate Resilient Seniors* project. *Climate Resilient Seniors* engaged the elderly community of Bridgeport in a series of participatory planning meetings from 2014-2015 around the focus of climate change vulnerability and adaptation.

Over the course of the first two meetings, the elderly participants characterized their vulnerability to climate change. Drawing from their own experience, they highlighted how climate related stressors currently affect them. They noted a range of effects including impacts to their physical and mental health, as well as their financial well-being. Contributing to their vulnerability, participants described personal characteristics associated with health, finances, social isolation, and marginalization, as well as contextual factors that could serve to exacerbate or mitigate the effect of these personal characteristics. Participants also shared a number of strategies that they currently use to prepare for, cope with, or recover from climate related stressors. In describing these strategies, they noted that many of them have secondary impacts that can also adversely affect the elderly. For example, running the air conditioner more to cope with heat waves causes additional financial challenges and staying home during days with poor air quality can increase social isolation.

With this understanding in mind, participants considered how predicted changes in climate could affect the elderly community of Bridgeport. They imagined multiple scenarios that could prove especially problematic for the elderly. In particular, they noted that a high percentage of elderly have limited capacity to adapt and so predicted changes could overwhelm their ability to cope. This is especially concerning as many of the coping strategies they currently employ have secondary negative impacts. Participants also mentioned how the elderly's potential lack of experience preparing for and coping with future extremes could put them at further risk. Within this context, elderly support services and emergency management services will both play essential roles in safeguarding the elderly.

Based on this picture of vulnerability, participants developed and distributed a survey to allow the greater elderly community to rank their level of concern over various factors that

can influence their vulnerability to climate change. Survey results indicate a high level of concern over a range of issues associated with climate related stressors.

In response to the survey results, participants reconvened for two additional meetings to develop adaptive strategies. With an effort at providing inclusive support to elders with a broad range of concerns and challenges, participants began by developing six overarching adaptation goals:

1. Encourage preparedness among seniors for extreme weather and other emergencies.
2. Provide effective warnings for seniors of extreme weather and other emergencies.
3. Provide seniors with resources for securing safe shelter.
4. Provide transportation resources that meet seniors' unique needs.
5. Provide resources to help seniors accomplish essential tasks during and following extreme weather.
6. Provide resources to aid seniors in the recovery process.

Building on these goals, participants then generated seven specific adaptation recommendations:

1. Provide emergency preparedness trainings specifically for seniors
2. Develop and distribute emergency preparedness informational materials specifically for seniors.
3. Conduct a reverse 911 sign up drive targeted at seniors.
4. Tailor warnings to meet seniors' needs.
5. Tailor shelters to meet seniors' needs.
6. Promote volunteer ridesharing and transportation assistance.
7. Establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors.

A prioritization process showed that participants believed all of the suggestions were likely to be effective and feasible to implement. Furthermore, as part of a post-project evaluation, the elderly participants indicated strong agreement that the adaptation recommendations reflected the concerns and needs of the elderly community of Bridgeport. They also indicated their belief that, if implemented, the recommendations would help keep Bridgeport's elders safer.

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Thank you to the many other organizations in Bridgeport that contributed to the research process. Included among these are Tim Bartlett and the Bridgeport YMCA, Bill Hoey and St. Vincent's Health System, Laura Palmieri and CW Resources, and Anita Vigeant and the Stratford Visiting Nurses Association.

Finally, a great thanks to the over 150 elders from Bridgeport who participated in the study. What follows reflects their wisdom, experience, and knowledge, and would not have been possible without their generosity and commitment to enhancing the common good of their fellow senior citizens.

Table of Contents

Note on language: elders and seniors. *The terms elder and senior are used interchangeably in this document to refer to individuals age 65 or above.*

This report is excerpted and adapted from the doctoral dissertation: *Enhancing the Resilience of Vulnerable Groups Through Participatory Climate Change Adaptation Planning: A Case Study with the Elderly Community of Bridgeport, Connecticut* by Jason L. Rhoades.

1. Introduction

In a number of recent reports and papers, the elderly (65 years and older) have been repeatedly recognized as having a heightened vulnerability to climate change (Cooper & Wadell 2010; Cutter et al. 2009; IPCC 2007; Lynn et al. 2011; Melillo et al. 2014; Morello-Frosch et al. 2009; O'Brien et al. 2008; Oxfam 2009;). These reports regularly cite the elderly's increased likelihood, in comparison to the general population, of pre-existing medical conditions and impairments, social isolation, and financial limitations as factors contributing to their vulnerability to climate change. While we have some understanding of the elderly's vulnerability to climate related stressors, to develop effective adaptation strategies to safeguard the elderly community of Bridgeport, as well as elderly communities elsewhere, it is also helpful to develop an in-depth understanding of the elderly's own perspective of their vulnerability, including their primary concerns as well as their preferred adaptation strategies.

To help develop this picture, Antioch University New England partnered with the city of Bridgeport Department on Aging to facilitate the *Climate Resilient Seniors* project. *Climate Resilient Seniors* engaged Bridgeport's elderly community in a participatory research and adaptation planning process. Throughout this process, over 50 elders participated in a series of discussion and planning meetings where they examined their own vulnerability to extreme weather and climate change and also developed strategies to address their vulnerability. Additionally, 164 seniors participated in a survey ranking their level of concern over various aspects of their vulnerability to climate change. This report presents the results of this project.

2. Climate Stressors

There are three primary climate related stressors predicted to worsen with climate change that pose the greatest risk to the elderly in Bridgeport: heat waves and extremely hot days, flooding and storms, and air pollution and allergens.

Heat Waves and Extremely Hot Days - One of the most prominent climate change impacts in the Northeast will be an overall temperature increase of 3 to 10 ^{0}F by 2080 (Horton et al. 2014). The increase in general temperatures will be accompanied by an increase in very hot days and heat waves in the Northeast. Even by conservative estimates, the number of days over 90^{0}F is expected to double in Northeastern cities like Bridgeport by the end of the century (Horton et al. 2014). The impacts of rising temperatures will be keenly felt in Bridgeport and other cities due, in part, to the heat island effect, a process where dark and reflective surfaces combine with a lack of natural materials to amplify extreme heat (Frumhoff et al. 2007).

Flooding and Storms – Along with changes in temperature, the frequency and intensity of heavy-precipitation events is predicted to increase. By conservative estimates, the number of heavy-precipitation events, or events with more than 2 inches of rainfall in a 48 hour period, are projected to double by the end of the century (Walsh et al. 2014). This heavy precipitation increases the risk of flooding in urban areas like Bridgeport, which are covered largely with impervious surfaces that prevent stormwater infiltration.

For coastal areas like Bridgeport, sea level rise will compound the risk of flooding and its associated impacts. By the end of the century, sea level is predicted to rise a minimum of 1 to 4 feet (Walsh et al. 2014). A rise in sea level will make flooding more of an issue in two ways. First, during a heavy-precipitation event, the water will have less opportunity to drain due to a higher water table. Second, higher sea levels will result in greater storm surges associated with coastal storms like hurricanes and nor'easters. In the case of powerful storms, like hurricanes, the flooding will likely be associated with additional difficulties including high winds, debris, and power outages. Researchers currently debate whether or not climate change will result in increased frequency or intensity of hurricanes, but some studies support that warming ocean temperatures appear to be increasing the intensity of hurricanes in the Atlantic Ocean (Ekwurzel 2006; Emanuel 2005; Villarini & Vecchi 2013; Webster et al. 2005).

Air pollution and allergens – Climate change will likely lead to higher levels of tropospheric ozone and fine particulate matter (CCSP 2008; IPCC 2007; Luber et al. 2014). This will occur as a result of three factors. First, warmer temperatures will accelerate ozone forming chemical reactions in the atmosphere. Second, predicted increases in the frequency and duration of periods of air stagnation will allow pollution to accumulate in certain areas. Third, a longer growing season and warmer weather in the Northeast will promote greater plant emissions of natural ozone precursors (Luber et al. 2014). As a result, fewer days will meet national air quality standards. Researchers predict that, even under conservative estimates, the number of days exceeding the EPA's 8-hour ozone standard will increase by 50% or more (Frumhoff et al. 2007). Air pollution will be especially challenging in Bridgeport and other cities that already suffer from poor air quality, especially if future levels of vehicle emissions and industrial pollution are not reduced below today's levels. As climate change will likely encourage plant growth in the Northeast, these human sources of air pollution may also be accompanied by increases in pollen and other allergens (Frumhoff et al. 2007).

3. The Elderly Community's Vulnerability to Climate Change

3.1 Methods

To examine the elderly community of Bridgeport's vulnerability to these stressors, the *Climate Resilient Seniors* project began with two participatory meetings held at Bridgeport's main senior center. The meetings were open to elderly residents of Bridgeport and were each an hour and a half in duration. During the meetings, elderly community members examined their current and potential future vulnerability. They began by discussing how they are currently impacted by climate related stressors, factors that contribute to their vulnerability, as well as strategies that they employ to prepare for, cope with, or recover from climate related stressors. Based on this understanding, they considered how predicted climate changes in Bridgeport might impact them and affect their vulnerability.

3.2 Participants

A total of 55 elderly community members participated in the two meetings. The participants comprised a diverse representation of Bridgeport's elderly community (Table 1). As the participants considered their vulnerability to climate change, they made a concerted effort to consider how their fellow community members who were not in attendance might also be affected.

Table 1. Demographic comparison of meeting participants with general elderly population of Bridgeport.

Category	**Meeting participants**	**Elderly population in Bridgeport (*n=55)***
Age (Average)	73.8	74.2
Age by Cohort (%)		
65-74	60	n/a
75-84	24	n/a
85+	16	n/a
Gender (%)		
Female	78.1	60.8
Male	11.9	39.2
Race (%)		
Asian	1.8	2.8
Black or African American	61.8	28.3
White	25.5	63.3
Other	10.9	5.6
Hispanic or Latino (%)	16.7	22.1
Living Alone (%)	49	59.9
Educational Attainment (%)		
Less than a High School degree	37.7	41.3
High School degree or equivalent	41.5	34.1

Some college/associates degree	15.1	14.6
Bachelors degree or higher	5.6	10.1
Living With a Disability (%)	56.6	41
Primary language (%)		
English	84.6	n/a
Spanish	9.1	n/a
Greek	1.8	n/a
Portuguese	3.6	n/a
Chinese	1.8	n/a
Speak English less than very well (%)	10.9	29
Employment (%)		
Full or part time	13.5	15.9
Unemployed or retired	86.5	84.1
Household income (%)		
Less than $10,000	58.7	n/a
$10,000-$20,000	26.1	n/a
$20,000-$40,000	13	n/a
$40,000+	4.3	n/a
Housing status (%)		
Owner occupied	40	55.6
Renter occupied	60	44.4

Note: Data for the general elderly population in Bridgeport is taken from the US Census Bureau's American Community Survey (2012).

3.3 Current impacts

Participants described multiple ways in which they and their community are currently impacted by extreme heat, air pollution, and flooding and storms (Table 2). These impacts included personal injury, illness, trauma, as well as damage to property. Impacts ranged from short term to long term. The impacts can be most easily grouped into those resulting from heat waves and air pollution, and those resulting from flooding and storms.

Table 2. Current impacts of climate related stressors on the elderly population of Bridgeport (as identified by participants).

Climate Related Stressors	**Current Impacts**
Heat waves and air pollution	General pain and discomfort including difficulty breathing and difficulty sleeping
	Mental upset including anxiety, depression, irritability
	Illness and hospitalization
	Isolation
	Difficulty doing essential tasks

Flooding and Storms	Property damage
	Loss of electricity leading to difficulties cooking, heating, or leaving apartment, also leading to loss of refrigeration and spoilage of food and medicines (i.e. insulin)
	Physical injury
	Illness and hospitalization
	Difficulty doing essential tasks
	Caregivers unable to access patients

Current Impacts of Extreme Heat and Air pollution – As a result of extreme heat and elevated air pollution, participants noted a variety of physical ailments including general pain and discomfort as well as difficulty breathing and difficulty sleeping. Participants also experienced a variety of psychological impacts including anxiety, depression, and irritability. In more severe cases, participants described illness and hospitalization following extreme heat and elevated levels of air pollution. Participants also explained how these events can serve to trap elders in their homes, leading to isolation and difficulty accessing needed resources or services, including groceries, medicine, or medical treatments. As one participant stated, "if it gets too hot, I just have to stay inside my house and can't go out."

Current Impacts of Flooding and Storms – Participants noted that storms and flooding could lead to physical injury that can be followed by a prolonged and difficult recovery process. Additionally, if electricity goes out as a result of a storm, elders could be unable to run needed medical equipment, heat their home, cook, or refrigerate their food. Loss of electricity could also result in the spoilage of medication, such as insulin, that requires refrigeration. Elders dependent on an elevator or stair lift could become trapped in their home. Participants also noted challenges coping with trauma and stress following storms and flooding. Additionally, elders described challenges travelling to get medications and medical treatments, as well as running errands during or following a storm. They also explained that storms and flooding can make it difficult for caregivers to access elderly individuals during and following storms or flooding. Additionally, participants described multiple ways that storms and flooding can result in damage to their property, with floods filling basements with water, and high winds damaging roofing or siding and bringing down limbs on their yard or house. They also explained how some of these impacts can in turn have health impacts. For example, sewage overflow and mold contamination following flooding can make homes unsafe and result in illness if left untreated.

3.4 Current Vulnerability

Participants identified a number of personal characteristics and contextual factors that contribute to their current vulnerability to these stressors and the severity of their experience of these impacts. In this effort, participants drew on their own experience and that of their fellow elders and considered factors that either increased their sensitivity or reduced their adaptive capacity.

3.4.1 Personal Characteristics

Participants noted a variety of personal characteristics ranging from health conditions to socioeconomic conditions that contributed to their vulnerability to climate change (Table 3).

Table 3. Personal characteristics contributing to the vulnerability of elderly individuals in Bridgeport to climate related stressors (as identified by participants).

Personal Characteristics	**Contributing factors/examples**
Chronic health conditions	Diabetes
	COPD
	Asthma
	Lung infections
Physical/cognitive impairments, disabilities	Alzheimer's
	Confinement to a wheelchair
	Poor hearing/vision
Social Isolation	Difficulty traveling
	Diminished social circle
	Living alone
Economic limitations	Retired or working part time with low/fixed income
	Minimal savings
	Poor credit
Marginalization	Poor English speaking ability
	Minority status
	Little formal education
	Low income levels

Chronic Health Conditions – Participants highlighted certain chronic health conditions prevalent among the elderly that can increase their sensitivity to climate change by causing adverse reactions to certain climate stressors. In particular, participants noted adverse reactions to high temperatures worsened by diabetes. Participants described how conditions including asthma, lung infection, and chronic obstructive pulmonary disease (COPD) can lead to more severe reactions to air pollution.

Physical/Cognitive Impairments and Disabilities - Living with a disability, a condition facing 41% of Bridgeport's elderly, was also noted as an important factor potentially reducing their adaptive capacity (US Census Bureau 2012). As an example, participants described how, for individuals confined to a wheelchair, traveling to a cooling center or shelter in a heat wave or storm can be extremely difficult. They noted how challenges with traveling can be exacerbated in emergency situations.

Participants described how Alzheimer's and other cognitive impairments can present challenges throughout the hazard life cycle, making it difficult for elders to receive and comprehend warnings, take needed steps to protect themselves, and navigate potentially complex recovery process. They highlighted that poor hearing can make it difficult for the elderly to hear or fully comprehend warnings associated with extreme weather and climate related stressors. They described how impairments and diseases can make elderly individuals dependent on the support of caregivers, leaving them at heightened risk during events like storms or flooding that can prevent caregivers from gaining access to them.

Social Isolation - As of 2012, 59.9% of elderly residents in Bridgeport lived alone (US Census Bureau 2012). Participants highlighted living by oneself as an important factor that contributes to the vulnerability of some elderly individuals. They suggested that elderly individuals living alone might be less likely to receive important information regarding climate related stressors such as warnings or instructions. Isolated elders with a limited ability to use modern communication technology could be at even greater risk of failing to receive warnings. Participants noted how isolated elderly individuals may lack the social support network to help them respond effectively to emergency situations. Participants voiced concern that these elders may not have the support needed to recover from illness, injury, or property damage resulting from climate related stressors and may not have the social support to assist in coping with associated mental trauma or stress. As one participant commented, "if there is a big storm, I don't have any living relatives to come check on me and see if I need help."

Economic limitations – As of 2012, 84.1% of Bridgeport's elderly residents were unemployed or retired and 17.3% of Bridgeport's elderly residents lived below the poverty line (US Census Bureau 2012). Participants identified a number of ways that lack of employment and living on a low or fixed income can reduce adaptive capacity by preventing elderly individuals from taking steps to prepare for, cope with, or recover from climate stressors. Elderly individuals may lack the money needed to make preparations to a residence to make it storm-safe, to find safe shelter in an emergency, or to conduct needed repairs or clean up after a storm or flood. In the context of heat waves and air pollution, financial limitations can prevent elderly individuals from purchasing and

running air conditioning or dehumidifiers. Economic limitations can also make receiving needed medical treatment or medication following an injury or illness more challenging.

Marginalization – In discussing the elderly, researchers typically note a variety of factors that can serve to marginalize individuals or groups thereby increasing their vulnerability to climate stressors. These include minority status, little formal education, and low-income levels (Gamble et al. 2013). Given the significant percentages of Bridgeport's elderly with these demographic characteristics (Table 1), it seems likely that marginalization contributes to the vulnerability of a substantial fraction of the elderly population in Bridgeport. In addition to highlighting the challenges associated with low income discussed above, participants observed that individuals with a limited command of the English language can face difficulties receiving warnings of impending severe weather, taking steps to protect themselves, and receiving needed support as part of the recovery process. While other factors, including minority status and educational attainment, were not discussed in depth by the group, participants did note that such characteristics could pose additional challenges.

3.4.2 Contextual Factors

In addition to personal characteristics, participants highlighted four contextual factors that can serve to enhance or limit the adaptive capacity of the elderly. In contrast to the previous characteristics, which were largely attributable to individuals, these contextual factors are rooted in the communities in which individuals reside and are associated with various initiatives and institutions promoting safety and well being among the elderly community. These contextual factors are: adequacy of transportation resources; effectiveness of public warning mechanisms; availability of resources to promote safe shelter; and adequacy of resources to aid in coping and recovery (Table 4).

Table 4. Contextual factors influencing the vulnerability of elderly individuals in Bridgeport to climate related stressors (as identified by participants).

Contextual Factors	**Associated Challenges**
Adequacy of transportation resources	Don't own a car
	Difficulty driving
	Inadequate public transportation
	Needing special accommodations
	Lacking money to pay for transportation
	Unaware of available resources

Effectiveness of warning mechanisms	Lack of technological fluency
	Isolation
	Poor English speaking ability
	Warnings difficult to understand
Availability of resources to promote safe shelter	Lack of money to pay for air conditioning or dehumidifiers
	Unable to conduct needed home repairs
	Lack of money to pay for emergency housing
	Insufficient shelters or cooling centers
	Difficulty accessing shelters of cooling centers
	Unaware of available resources
Adequacy of resources to aid in coping and recovery	Lack of mental health resources
	Difficulty accessing medical resources
	Difficulty performing essential activities
	Difficulty repairing damages to property
	Unaware of available resources

Adequacy of transportation resources – Participants noted that adequate transportation resources are vital for elderly individuals to gather resources needed to prepare for climate related stressors, to seek safe shelter away from home if needed, and to access needed resources and services to aid in their recovery. Many of the personal characteristics described above, including certain disabilities, diminished sensory awareness, and financial limitations, can make it difficult for elderly individuals to drive or own a car. As a result, many elderly are highly dependent on public transportation for meeting these needs. Even for individuals who can normally drive a car, inclement weather and potential flooding during severe storms may make them unable to drive or uncomfortable doing so, causing them to seek alternative transportation. As a result, participants shared that their vulnerability to climate related stressors depended in part on the availability of transportation options to bring them from their home to grocery stores, shelters, cooling centers, clinics, and hospitals. Given the limited financial resources of many elderly, participants noted that these options have to be very inexpensive. They highlighted that transportation options need to be able to accommodate and support individuals with a variety of disabilities as well as people who may need to bring specialized medical equipment or supplies with them. Finally, they highlighted that the elderly community also needs to be aware of transportation resources and how they can access them.

Effectiveness of warning mechanisms – In addition to the importance of transportation resources, participants noted it is important for elders to receive adequate warning of upcoming climate related stressors so that they can take steps to protect themselves.

Again, personal characteristics, including social isolation, cognitive impairments, diminished sensory awareness, and a lack of technological fluency, can make it difficult for governments or other support organizations to provide elders with adequate warning. It is even more difficult to reach elderly individuals with limited English speaking ability. To overcome these challenges, participants noted that it is important for warnings to be distributed using appropriate technology to reach elderly populations, with information relevant to the elderly and their needs, and be communicated clearly in a manner that will be understandable to elderly individuals with a variety of cognitive and sensory capacities. Considering appropriate technology for distributing warnings, participants suggested that they preferred to be contacted by telephone or in person. This latter approach suggests a need to mobilize community organizations in reaching out to elderly individuals to make sure they are aware of and prepared for upcoming climate related stressors.

Availability of resources to promote safe shelter – Participants noted the importance of having access to safe shelter during extreme weather or climate related hazards. They explained that this could include making their home safe from climate related stressors, either through home repairs to weather storms, or through purchasing and running air conditioning in a heat wave or period of elevated air pollution. Financial limitations can make this challenging for many elders and can also prohibit them from being able to pay for alternate shelter in an emergency. As a result, participants highlighted the importance of having emergency shelters and cooling centers available. They also noted that shelters need to be able to accommodate elderly individuals with special needs and that the elderly need to be aware of the location of shelters. This is not always the case, as one participant commented, "I have no idea where they are or what to bring." Additionally, participants highlighted the importance of having adequate transportation resources to bring the elderly to shelters or cooling centers.

Adequacy of resources to aid in coping and recovery – Given the potential for climate related stressors to result in physical injury, trauma, stress, illness, or property damage, participants noted the importance of resources to aid the elderly in coping and recovery. They described how financial limitations, disabilities, and chronic medical conditions can make it difficult for the elderly to travel to or afford needed medical treatments or medications. Elderly individuals with these conditions could have difficulty accomplishing essential tasks during or following a climate related stressor. These conditions can make it difficult for elderly individuals to personally undertake or pay for home repairs or clean up after storms. Participants highlighted the importance of support in these diverse aspects of the recovery process. As with the other factors, they noted that the elderly need to be aware of these resources and accessing them needs to be simple enough for them to navigate.

3.5 Current adaptive strategies and resources

Against this backdrop, participants shared a number of adaptive strategies and resources that they currently employ to prepare for, cope with, and recover from extreme weather and other climate related stressors (Table 5).

Table 5. Current adaptive strategies utilized by elderly individuals in Bridgeport to prepare for, cope with, or recover from climate related stressors (as identified by participants).

Climate Related Stressors	**Current Strategies**	**Secondary Impacts/Limitations**
Extreme heat and air pollution	Stay inside	Leads to increased isolation and difficulty doing essential tasks
	Close windows and run AC/dehumidifier	Leads to increased electricity costs
	Travel to hospital	Costs money and time, causes mental and physical fatigue
Flooding and Storms	Stay in a hotel	Costs money
	Stay with family or friends	Only possible for seniors with family or friends nearby
	Pay for clean up/repair work	Costs money

Current adaptations to extreme heat and air pollution - Participants noted a number of adaptive strategies they employ in the contexts of extreme heat and poor air quality. They explained how they often remain indoors at home during times of extreme heat or poor air quality, but noted how this can lead to ongoing isolation and prohibit elderly individuals from running important errands to obtain medical treatments and groceries. Some participants described closing their windows and running air conditioning, but they added that the latter approach presents an additional expense that many elders cannot afford, especially as energy costs have been steadily rising. One participant compellingly explained, "it sets a double standard, where those who can afford it can protect themselves, but those who can't, especially those living alone and on a fixed income, are more at risk." During heat waves, participants highlighted a number of additional ways that they modify their behavior, including dressing light, drinking extra fluids, taking cool showers, closing the blinds, and eating light foods. In the context of air pollution, some participants also noted that they have to use breathing machines, which makes it difficult for them to travel and run errands. Finally, as a result of extreme heat and poor air quality, participants explained that they sometimes need to travel to the hospital for treatments. When this occurs, participants described that it can be difficult for them to travel and also can be financially burdensome and overly time consuming.

Current adaptations to flooding and storms – Some participants mentioned needing to seek shelter in a hotel during storms if they felt their home was or might become unsafe. They also noted that this was an expensive option that was challenging or unavailable for many

elderly given their limited economic resources. Some participants also described how they would go to stay with friends and family during or following a storm if their home might be unsafe or was damaged. Again, participants explained that this would not be an option for isolated elders lacking a local social support network. Finally, following floods and storms, participants described how they were often incapable of undertaking the needed clean-up or repairs to their property and, as a result, have had to pay someone for those services. Participants highlighted the challenges of paying for this added expense.

3.6 Potential impacts of predicted climate changes on elderly vulnerability

Participants described two primary ways in which their vulnerability may be impacted by predicted changes in heat waves and extremely hot days, flooding and storms, and air pollution and allergens. First, previously unaffected or little affected elders may be underprepared to cope with increasing impacts if climate related stressors intensify. Second, this increasing intensity coupled with an increase in the frequency of climate related stressors could overwhelm the adaptive capacity of some elderly individuals.

Currently, some elderly individuals may be largely unaffected by various climate related stressors. As climate change progresses, however, these individuals may begin to be adversely impacted and they could find themselves unprepared and without any previous coping experience. The lack of preparedness and coping strategies could heighten the vulnerability of those elderly. For example, an elderly individual's basement may have never experienced flooding during the decades she has lived there, but increases in heavy precipitation events could result in severe flooding causing damage to the residence. As another example, an elderly individual who has been previously unaffected by high temperature days may find herself experiencing heat related illnesses as the upper range of the intensity of heat waves increases. In both cases, the individuals could lack important information or strategies and, as a result, could face significant challenges coping with and recovering from these novel impacts.

Even elderly individuals who have been previously impacted by certain climate related stressors may find their previous adaptive strategies insufficient to protect themselves from predicted changes. Participants suggested that even small changes in the intensity of climate related stressors can have a significant impact on some elderly individuals. As one shared "even a difference of a couple degrees in temperature can be a big deal to me."

Participants noted that, in both of these cases, the risk to the elderly could be increased if they underestimate the severity of future extreme weather events. Some elderly, they suggested, may base their decision making about how to prepare for future events on their past experience with similar events. While this approach might have served them

reasonably well in the past, if certain climate stressors increase in intensity, it could result in elderly individuals underpreparing for more severe events, thereby putting them more at risk.

Even if elderly individuals perceived the risks they face as severe and wished to protect themselves from those risks, climate change could fundamentally overwhelm their adaptive capacity. As participants described, the adaptive capacity of many elderly can be severely limited by numerous factors including a lack of financial resources, social isolation, health conditions and disabilities, and marginalization. As was illustrated in the descriptions of various adaptive strategies that the elderly currently employ, many of their current approaches can have secondary impacts that can serve to further draw down their existing adaptive capacity. If the elderly are forced to employ these adaptive strategies to a greater degree, the secondary impacts could exhaust their economic, physical, mental, and social resources. This is exemplified by one participant's concern, "sure I could run my AC more, but that cost more money that I don't have, so where am I going to get the money from?" Furthermore, climate stressors will not be changing in isolation, but predictions contend that extreme heat, flooding and storms, and air pollution will all increase in concert. Even if individuals were able to muster the resources to safeguard themselves from increases in one stressor, concurrent increases in other stressors may prove overwhelming. For example, even if the previously quoted participant could find the financial resources to run the additional air conditioning required to cope with increasing heat waves, concurrent increases in home repair costs from more severe storms may be more than she could afford.

3.7 Prioritizing the elderly community's concerns over climate change

These potential impacts highlight the vitally important role that contextual factors, such as effectiveness of warning mechanisms and the availability of resources to promote safe shelter, will need to play in protecting the elderly from the impacts of climate change. In order to design adaptation measures that effectively address the needs of the elderly community, it is important to understand which of these contextual factors they are most concerned about.

To allow a diverse range of Bridgeport's elderly community to prioritize their concerns, a Likert scale survey was designed and distributed to seniors through multiple organizations including the Bridgeport Department on Aging's three senior centers, CW Resources' Meals on Wheels Program, St Vincent's Medical Center, the Bridgeport YMCA, the Stratford Visiting Nurses Association, and local houses of worship. The survey allowed participants to rank their level of concern about multiple factors contributing to their vulnerability on a five point scale ranging from "unconcerned" to "very concerned."

A total of 164 elders completed the survey. While the survey was not a random sample, and so can not be generalized to the larger elderly population of Bridgeport, demographic data collected from a random subset of 1 in 5 participants demonstrates that the survey reached a diverse representation of Bridgeport's elderly community (Table 6). The demographic data also shows that the survey reached segments of the elderly population with characteristics such as living alone or living on a low income, that may put them at heightened risk to climate related stressors and who are therefore in greatest need of assistance.

Table 6. Demographic comparison of survey respondents with general elderly population of Bridgeport.

Category	Survey respondents	Elderly population in Bridgeport (*n=35)*
Age (Average)	75.3	74.2
Age by Cohort (%)		
65-74	51.4	n/a
75-84	25.7	n/a
85+	22.9	n/a
Gender (%)		
Female	77.1	60.8
Male	22.9	39.2
Race (%)		
Asian	2.9	2.8
Black or African American	54.3	28.3
White	28.6	63.3
Other	14.3	5.6
Hispanic or Latino (%)	23.5	22.1
Living Alone (%)	51.4	59.9
Educational Attainment (%)		
Less than a High School degree	42.9	41.3
High School degree or equivalent	37.1	34.1
Some college/associates degree	11.4	14.6
Bachelors degree or higher	8.6	10.1
Living With a Disability (%)	52.9	41
Primary language (%)		
English	77.1	n/a
Spanish	14.3	n/a
Chinese	2.9	n/a
Croatian	2.9	n/a
Hungarian	2.9	n/a

Speak English less than very well (%)	17.1	29
Employment (%)		
Full or part time	14.3	15.9
Unemployed or retired	85.7	84.1
Household income (%)		
Less than $10,000	55.2	n/a
$10,000-$20,000	17.2	n/a
$20,000-$40,000	20.7	n/a
$40,000+	6.9	n/a
Housing status (%)		
Owner occupied	63.3	55.6
Renter occupied	36.7	44.4

Note: Data for the general elderly population in Bridgeport is taken from the US Census Bureau's American Community Survey (2012).

The survey results highlight the respondents' generally high level of concern over climate related stressors (Table 7). Respondents ranked 14 of the 40 questions as an average of 3 or above and more than 30% of respondents ranked 23 of the 40 questions as high concerns (4 or 5 on the Likert scale). A number of participants' most pressing concerns focused on receiving adequate warning. Specifically, this included concerns over not receiving warnings or of receiving warnings that do not have enough information or are hard to understand. Participants also expressed higher levels of concern over factors related to shelter, including concerns over the safety of their homes, difficulties getting to shelter locations, the safety and comfort of shelter locations, as well as the availability of shelters. Additionally, participants ranked certain issues related to getting assistance and the recovery process as particularly concerning. These included concerns over travelling to the hospital both during and following climate related stressors, getting food and supplies, doing essential activities while electricity is out, coping with trauma and stress, and conducting repairs and clean up on their property following a storm or flood.

Table 7. Survey results showing respondents average level of concern over various issues associated with extreme weather as well as the percentage of respondents that ranked each issue as a high concern. (*n= 164*).

Receiving Adequate Warning	**Average Level of Concern**	**% Highly Concerned**
Won't receive warning	3.58	50%
Warning won't have enough info	3.74	62%
Warning will be hard to understand	3.48	51%
Warning won't be in my language	1.97	18%

Staying Safe at Home		
My house is unsafe and can't afford to fix	3.29	47%
Can't afford to run ac in heat wave	2.76	36%
Can't afford to run AC in air pollution	2.67	35%
Having Adequate Transportation Resources		
Lack of public transportation where I live	2.49	29%
Lack of ride sharing where I live	2.89	39%
Public transport is too expensive	2.46	26%
Can't afford transportation in emergency	2.54	27%
It is physically difficult for me to travel	2.29	19%
It is hard to travel because of equip needs or medicine	2.07	16%
Finding Safe Shelter		
Don't know where shelter is located	2.92	39%
Hard for me to get to shelter	3.01	46%
Shelters are unsafe	3.14	44%
Shelters are uncomfortable	3.08	40%
There are not enough shelters	3.45	57%
Hard for me to stay in shelter because of equip needs or medicine	2.48	28%
Getting Needed Assistance		
No one will check on me during or after extreme weather	2.90	30%
Don't know emergency numbers	2.86	38%
Won't be able to leave my building if power is out	2.19	19%
Will be difficult for caregivers to reach me in storm	2.65	32%
Will be difficult to get to hospital or get medicine during or after extreme weather	3.08	43%
Will be difficult to get food and supplies during or after extreme weather	3.25	47%
If electricity is out, will be difficult to do essential activities	3.45	51%
Having Resource to Aid in Recovery		
Difficulty coping with trauma and stress	3.05	36%
Difficult to travel to hospital for treatment if injured or sickened	3.27	47%
Difficult to afford medication or treatment if injured or sickened	2.93	34%
Won't have needed support to do daily tasks if injured or sickened if injured or sickened	2.94	32%

Difficult to do clean up or repairs to property	3.19	47%

Note: For Likert scale, 1=unconcerned and 5=very concerned. For % highly concerned, a ranking of a 4 or 5 is considered a high level of concern.

While it is important to note the most prominent concerns of the respondents, it is also important to pay attention to concerns that might be held by specific sub-groups within the elderly community. As the meeting participants discussed, vulnerability is made up of multiple personal characteristics and contextual factors. The composition and impact of these factors vary greatly among elderly individuals. As a result, certain sup-groups within the community many have specific needs or concerns based on unique aspects of their vulnerability. For example, concerns over not receiving warnings in a language you understand will only affect elderly individuals who do not speak English or who speak it poorly. While this sub-group only represents 29% of the city's total elderly population, and so their concern will not be shared generally, it is an important factor contributing to the vulnerability of those individuals. This relatively low level of overall concern but high level of concern for a specific sub-group is seen in the survey results, with concern over warnings not being in an individual's language ranking a 1.97 overall, but with 18% of respondents ranking this as a high concern. While this is not a commonly shared concern in the community, it is an important concern for that 18% of respondents. Their concern deserve due consideration by government agencies, non-profits and other support organizations. Such a perspective presents the survey results in an additional light, as all 40 questions were ranked as high concerns by over 15% of respondents. From this perspective, all of the issues presented in the survey represent important concerns to over 15% of the respondents and as such merit further attention and effort to find opportunities to support elders with those concerns.

4. Adaptation Recommendations

4.1 Methods

In response to the understanding of the elderly community's vulnerability and the concerns expressed in the survey, we had two additional meetings with the elderly community of Bridgeport to develop adaptation strategies that promote greater resilience. As with the previous meetings, these meetings were open to the elderly community of Bridgeport and were held at the centrally located Eisenhower Senior Center. City staff from the Department on Aging and the Office of Emergency Management and Homeland Security also attended the meeting to assist participants in developing their adaptation strategies by providing additional context, as needed, regarding existing city programs. Demographic data was collected at both meetings to ensure that a diverse representation of elderly community was included in the meetings.

The two meetings followed the adaptation planning approach and best practices described in Snover et al. (2008) and the NRC (2010) and Gruber et al. (2015). First participants developed a set of general guiding goals for the overall adaptation effort and then continued to develop specific actions that could further those goals. In developing, and later prioritizing, these actions, participants followed the following recommendations described in the abovementioned documents:

- Utilize, modify, or partner with existing programs.
- Enlist outside partners.
- Develop multiple overlapping approaches to enhance the resilience.
- Focus on actions that achieve multiple benefits both within and outside of the context of climate change.

4.2 Participants

A total of 37 elderly community members participated over the course of the two adaptation planning meetings. Demographic data collected at the meetings show that the participants comprised a diverse representation of the elderly community of Bridgeport (Table 8). This data shows that many of the most vulnerable, in terms of economic factors, education levels, minority status, and presence of a disability were included in the planning.

Table 8. Demographic comparison of meeting participants with general elderly population of Bridgeport.

Category	Meeting participants	Elderly population in Bridgeport (*n=37*)
Age (Average)	74.4	74.2
Age by Cohort (%)		
65-74	53.1	n/a
75-84	28.1	n/a
85+	18.8	n/a
Gender (%)		
Female	74.3	60.8
Male	25.7	39.2
Race (%)		
Asian	3.0	2.8
Black or African American	73.5	28.3
White	23.5	63.3
Other	0	5.6
Hispanic or Latino (%)	7.7	22.1
Living Alone (%)	48.6	59.9

Educational Attainment (%)		
Less than a High School degree	35.3	41.3
High School degree or equivalent	41.2	34.1
Some college/associates degree	17.6	14.6
Bachelors degree or higher	5.9	10.1
Living With a Disability (%)	58.8	41
Primary language (%)		
English	88.6	n/a
Spanish	5.7	n/a
Portuguese	2.9	n/a
Chinese	2.9	n/a
Speak English less than very well (%)	11.1	29
Employment (%)		
Full or part time	14.3	15.9
Unemployed or retired	85.7	84.1
Household income (%)		
Less than $10,000	53.6	n/a
$10,000-$20,000	35.7	n/a
$20,000-$40,000	10.7	n/a
$40,000+	0	n/a
Housing status (%)		
Owner occupied	55.2	55.6
Renter occupied	44.8	44.4

Note: Data for the general elderly population in Bridgeport is taken from the US Census Bureau's American Community Survey (2012).

4.3 Climate Change Adaptation Goals

With the aim of inclusively addressing the diverse characteristics and factors that contribute the vulnerability of the elderly as well as their broad concerns, participants developed six general adaptation goals:

1. Encourage preparedness among seniors for extreme weather and other emergencies.
2. Provide effective warnings for seniors of extreme weather and other emergencies.
3. Provide seniors with resources for securing safe shelter.
4. Provide transportation resources that meet seniors' unique needs.
5. Provide resources to help seniors accomplish essential tasks during and following extreme weather.
6. Provide resources to aid seniors in the recovery process.

Encourage preparedness among seniors for extreme weather and other emergencies. For the elderly to stay safe during extreme weather and other emergencies, the participants indicated that it is vital that they are well prepared. They explained that this includes knowing what to do in an emergency, having needed supplies on hand, and being aware of resources to aid in preparing for, coping with, and recovering from extreme weather. They also noted that preparedness measures need to focus on the unique causes of vulnerability among the elderly population.

Provide effective warnings for seniors of extreme weather and other emergencies. Participants shared that, when extreme weather is predicted, it is vital that the elderly receive adequate warning to prepare. This necessitates finding strategies to distribute warnings even to socially isolated elders who have limited use of communication technologies. They recommended that warnings need to be clearly understandable by the elderly despite potential sensory or cognitive impairments. Warnings also need to contain information relevant to the elderly about what they can do to protect themselves.

Provide seniors with resources for securing safe shelter. Participants noted that, due to the elderly's heightened vulnerability to climate change, it is important for them to be able to access safe shelter in the event of extreme weather. In some cases, elders may feel comfortable taking shelter at their home and it is important to develop resources to promote this. In other cases, it will be important for them to be able to access emergency shelters and cooling centers. In addition to accessibility, participants highlighted that it is important that elders feel safe and comfortable in these locations.

Provide transportation resources that meet seniors' unique needs. Participants noted that transportation plays an important role in helping many elders prepare for, cope with, and recover from extreme weather. This can include gathering needed supplies to prepare for predicted weather, evacuating in an emergency, or accessing needed medical treatment following an injury or illness. Participants also highlighted that transportation can be a significant challenge for the elderly, as many elders can not drive, lack the expendable income to pay for transportation services, and/or have disabilities and medical conditions that can make travel difficult. Participants emphasized that there needs to be affordable and accessible public transportation resources that can accommodate the unique needs of elderly individuals travelling with disabilities or who may need to bring medical equipment or supplies with them.

Provide resources to help seniors accomplish essential tasks during and following extreme weather. Participants noted that the elderly may face significant challenges accomplishing essential tasks during or following extreme weather and other climate related stressors. This is an especially pressing concern for socially isolated elders. They suggested that it is

important to have resources to support seniors both during and following such events to ensure that they are safe and able to accomplish essential tasks to maintain their well being.

Provide resources to aid seniors in the recovery process. Participants noted that elderly individuals can face significant challenges recovering from extreme weather and other climate related stressors. This can be a result of multiple factors including financial limitations, physical and mental impairments, difficulties travelling, and social isolation. Participants highlighted the importance of resources to aid elderly individuals in the recovery process. They also emphasized that elders need to be aware of these resources and need to be able to navigate the processes needed to access them.

4.4 Recommended Adaptation Strategies

To achieve these goals, participants developed seven initial adaptation recommendations:

1. Provide emergency preparedness trainings specifically for seniors.
2. Develop and distribute emergency preparedness informational materials specifically for seniors.
3. Conduct a reverse 911 sign up drive targeted at seniors.
4. Tailor warnings to meet seniors' needs.
5. Tailor shelters to meet seniors' needs.
6. Promote volunteer ridesharing and transportation assistance.
7. Establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors.

Provide emergency preparedness trainings specifically for seniors. To help promote preparedness, the participants recommend that the city of Bridgeport develop and present emergency preparedness trainings designed specifically for seniors. They suggested that these trainings focus on hazards associated with extreme weather including extreme heat, flooding and storms, and air pollution. Potential locations for the trainings include senior centers, houses of worship, schools, and libraries. In considering locations for the trainings, participants highlighted accessibility via public transportation as well as adequate parking as important factors.

Among the information important for the elderly community, participants recommended including information on existing resources that can help seniors prepare for and cope with climate related stressors, such as shelter locations, transportation resources available in emergency situations, resources to help individuals fill prescriptions during emergencies, and the relevant emergency phone numbers. They recommended including information on

how to sign up for priority electricity restoration with the electric company and how to sign up with the city for the Reverse 911 program, which automatically calls people on their phones with emergency warnings. They suggested including information on resources to help with the recovery process, including programs targeted at providing physical and mental health services as well as programs designed to provide food, in home assistance, and home repair. They recommended including information on the amount of prescription medication to have on hand as well as how to fulfill prescriptions in an emergency.

They suggested that it would be beneficial for the elderly to learn about emergency preparedness steps that they should take. These could include how to develop an emergency preparedness plan, what to put in a preparedness kit, what supplies to have at home in case of an emergency, and how to create low cost emergency preparedness "hacks." This last suggestion, including creative solutions such as filling a cooler with ice and placing a fan on top to provide low cost air conditioning during a heat wave, has great potential to keep elders with financial limitations safe. As part of developing an emergency preparedness plan, participants suggested that elderly individual's establish a "buddy" to aid them in dealing with extreme weather. Principally, this buddy could make sure they are aware of and prepared for upcoming threats and check in on them during and following climate related stressors or other emergencies.

Participants suggested a diverse outreach strategy for the trainings to encourage strong attendance among the elderly population. First, they suggested distributing multilingual fliers to promote the trainings through a diverse set of organizations that interact with the elderly. Specifically, they recommended the city's senior centers, houses of worship, local hospitals, the YMCA, as well as local affiliates of elderly support organizations including AARP, Meals on Wheels, and the Visiting Nurses Association. To reach diverse elders with varying technological capacities, they suggested promoting the event through social media and by posting fliers at drug stores and grocery stores. In these promotions, they noted the importance of advertising free refreshments, which would serve as an effective incentive to attract elders to the trainings.

<u>Develop and distribute emergency preparedness informational materials specifically for seniors</u>. In addition to the trainings, participants suggested that it is important for elderly individuals to have information on hand to help them in preparing for, coping with, and recovering from extreme weather and other emergencies. To help provide this, they suggested that the city of Bridgeport develop and distribute print materials with emergency preparedness information and relevant resources for the elderly. Participants recommended providing the information in two formats, a refrigerator magnet and a booklet. On the magnet, they recommended presenting the most important emergency

phone numbers. For the booklet, they suggested preparing a condensed collection of the same information they recommended for the preparedness trainings, including relevant resources and preparedness measures. For both the magnet and booklet, they highlighted that the material should be targeted at elders' unique needs and should be presented in large font. Participants recommended distributing the materials through multiple organizations and locations including the senior centers, houses of worship, hospitals, the YMCA, AARP, Meals on Wheels, and the Visiting Nurses Association. They also noted it would be helpful to hand out these materials at the emergency preparedness trainings.

Conduct a reverse 911 sign up drive targeted at seniors. To help provide adequate warning of potentially hazardous events, participants suggested conducting a sign up drive to enroll elders in the city's "Reverse 911" program, which calls registered individuals on their home phone with warnings and notices. In an additional survey question, a plurality of the 164 elderly respondents (38%) ranked telephone calls as their preferred way to receive warnings. The Reverse 911 program offers an easy and effective way for elderly individuals to receive warnings over the phone. To ensure that this program reaches as many people as possible, the participants suggested that the city of Bridgeport partner with additional organizations to conduct a reverse 911 sign up drive targeted specifically at the elderly population. They recommended distributing multilingual fliers to promote the event through organizations including senior centers, houses of worship, local hospitals, the YMCA, AARP, Meals on Wheels, and the Visiting Nurses Association. They recommended posting fliers advertising the event at local grocery and drug stores. In addition they recommended using social media and local TV stations to promote the sign up drive.

Tailor warnings to meet seniors' needs. To help ensure that warnings are clear and informative for the elderly, they suggested a set of guidelines for the city of Bridgeport to follow when issuing warnings, including those distributed by Reverse 911. First, warnings should be given in a slow and clear message and then repeated. Second, warnings need to contain information relevant to the elderly, including shelter locations, as well as transportation and medical resources as needed. Third, warnings need to be given in multiple languages. These guidelines could also be shared with local radio and TV stations. In addition, it would be beneficial if warnings airing on the TV were also displayed as text at the bottom of the screen.

Tailor shelters to meet seniors' needs. Participants suggested multiple actions to increase the accessibility and comfort of shelters. To increase the accessibility of shelters, participants recommended that the city seek to develop additional shelter locations. In particular, they suggested that the city could encourage houses of worship to become official emergency shelters. Participants selected houses of worship as good potential

partners because they are spread across the city and many elders are familiar with their locations and would be comfortable traveling and staying at one in a time of need. The primary action this would require on the part of the houses of worship would be to install a generator to provide ongoing electricity in case of a power outage. Along with developing additional shelters through this partnership, participants also suggested that the city take steps to make shelters more comfortable for the elderly community. Specifically, they recommended playing soothing music and offering snacks.

Promote volunteer ridesharing and transportation assistance. To help provide additional transportation resources for the elderly, participants suggested that the city of Bridgeport establish a volunteer program that provides rides to elders. Potential volunteers could be vetted by the city and then, if approved, could be placed on a roster of individuals willing to provide rides for elders. As part of this process, volunteers could specify their hours of availability and elders could call a central number to request a ride. Similar programs exist in other areas that could serve as examples to guide the development of this program.

Establish a telephone-based clearinghouse for extreme weather and emergency related resources for seniors. Many resources are currently available to meet elders needs before, during, and following extreme weather and other climate related stressors, but elders are often unaware of them or can have difficulty navigating computer technology to identify and access those resources. To address these challenges, participants suggested that the city of Bridgeport establish an extreme weather/emergency informational phone number that could serve as a clearinghouse for the elderly community's questions and needs. This number would be intended to connect elders to information and resources, not to serve as an emergency number such as 911. Elders calling the number could be presented with a menu of resource options that they could choose from. These could include transportation resources, medical resources, nutrition resources, recovery resources, and mental health resources. After selecting an option, elders could be provided contact information to various organizations and programs that provide those services. This number could also be an avenue for elders to share concerns and requests with the city.

4.5 Prioritization and Evaluation

As a means of prioritizing the most promising adaptation strategies, the 35 elderly participants then ranked each of these suggestions based on their potential positive impact reducing the risk climate change poses to the elderly community of Bridgeport. They also ranked each suggestion in terms of its potential feasibility to implement. These two factors were ranked on a scale of 1 to 5, with a ranking of 5 denoting recommendations with the highest potential impact and feasibility and 1 denoting those with the least potential in either regard. To provide another lens on these questions, 7 city staff from the Department

on Aging as well as the Office of Emergency Management and Homeland Security separately raked each suggestion's impact and feasibility. The rankings were then averaged for each group to produce two sets of overall scores for each recommendation (Table 9).

Table 9. Average impact and feasibility rankings for each adaptation recommendations as indicated by elderly participants and city staff.

Adaptation Recommendations	Elderly Participants (*n=35*)		City Staff (*n=7*)	
	Impact	**Feasibility**	**Impact**	**Feasibility**
1. Provide emergency preparedness trainings specifically for seniors	4.6	4	4.7	3.7
2. Develop and distribute emergency preparedness informational materials specifically for seniors.	4.7	4.2	5	4.3
3. Conduct a reverse 911 sign up drive targeted at seniors.	4.5	4	4.3	3.6
4. Tailor warnings to meet seniors' needs.	4.6	4.5	4.7	4.7
5. Tailor shelters to meet seniors' needs.	4.3	4	4.3	4.4
6. Promote volunteer ridesharing and transportation assistance.	4.1	3.7	4.2	4.4
7. Establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors.	4.5	4.2	4.6	4.7

Note: For Likert scale, 1=low impact/feasibility and 5=high impact/feasibility.

All of the recommendations received high marks for their potential impact as well as their feasibility from both the elderly participants and the city staff. Given their high rankings in both regards, it would appear that all of the recommendations warrant further development. Adaptation recommendations 2, 4, and 7 (develop and distribute emergency preparedness informational materials specifically for seniors, tailor warnings to meet seniors' needs, and establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors) received the highest rankings. Focusing initially on the implementation of these recommendations might be an advantageous first step that could help generate significant early successes thereby bolstering support for further efforts.

Providing additional support for the implementation of these recommendations, the elderly participants indicated their unanimous agreement in a final evaluation of the project that the recommendations reflected the needs and concerns of the elderly and would help make Bridgeport's elderly community safer (Table 10).

Table 10. Elderly participant responses to project evaluation questions. (*n=35*).

Evaluation Statements	Average level of agreement
The recommendations of this project reflect the concerns and needs of the elderly.	5.0
The recommendations of this project will help make Bridgeport's seniors safer.	5.0

Note: For Likert scale, 1=strong disagreement and 5 = strong agreement.

5. Conclusions

Climate change poses serious risks for the elderly community. Due to their high vulnerability to climate related stressors and limited capacity to adapt to changes, the efforts of elderly support and emergency management services will be essential to keeping the elderly safe. The picture developed by the elderly through this project of their own vulnerability to climate change and their prioritization of their concerns as demonstrated in the survey presents a important first hand description which can be used to inform adaptation planning. Additionally, the adaptation recommendations they developed provide an important resource to help guide adaptation planning.

In addition to the elderly's own support of the adaptation recommendations, the recommendations also deserve consideration because they incorporate many adaptation planning best practices that could improve their efficiency and effectiveness. Specifically, a number of the recommendations:

- Build off of existing programs to improve efficiency.
- Enlist multiple organizations to build strong partnerships and develop more comprehensive solutions.
- Promote multiple approaches to strengthen resilience.
- Propose actions that have the potential to produce positive outcomes under a range of climate futures.

Given the positive features identified in these recommendations, the organizations and institutions with the capacity for implementation are strongly encouraged to consider acting upon them. Through an ongoing collaboration with the direct engagement of the elderly community and a focus on the unique challenges posed by a changing climate, these organizations and institutions can continue their exemplary work to safeguard the elderly community of Bridgeport and promote their well being.

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Appendix B. Vulnerability questions discussed in first two meetings

Heat Waves and Extremely Hot Days Working Group

1. How are you currently impacted by heat waves and extremely hot days? *(Consider impacts to physical and emotional health, and finances, as well as other impacts.)*

2. What factors contribute to your vulnerability to heat waves and extremely hot days? *(Try to connect specific factors with specific impacts.)*

3. What approaches have you used to successfully prepare for, cope with, or recover from heat waves and extremely hot days in the past?

4. How might predicted changes in heat waves and extremely hot days impact you in the future? *(Consider impacts to physical and emotional health, and finances, as well as other impacts.)*

Air Pollution and Allergens Working Group

1. How are you currently impacted by air pollution and allergens? *(Consider impacts to physical and emotional health, and finances, as well as other impacts.)*

2. What factors contribute to your vulnerability to air pollution and allergens? *(Try to connect specific factors with specific impacts.)*

3. What approaches have you used to successfully prepare for, cope with, or recover from air pollution and allergens in the past?

4. How might predicted changes in air quality impact you in the future? *(Consider impacts to physical and emotional health, and finances, as well as other impacts.)*

Flooding and Storms Working Group

5. How are you currently impacted by flooding and storms? *(Consider impacts to physical and emotional health, finances, and property, as well as other impacts both during and following floods and storms.)*

6. What factors contribute to your vulnerability to flooding and storms? *(Try to connect specific factors with specific impacts.)*

7. What approaches have you used to successfully prepare for, cope with, or recover from flooding and storms in the past?

8. How might predicted changes in flooding and storms impact you in the future? *(Consider impacts to physical and emotional health, finances, and property, as well as other impacts both during and following floods and storms.)*

Appendix C: Demographic survey

Climate Resilient Seniors

Participant Background Survey

Thank you for completing this background survey. Your answers will help us make sure that we are including a diverse and representative sample of Bridgeport's senior community.

1. What is your age? _____ years

2. What is your gender?
   - ☐Male
   - ☐Female

3. What race best describes you?
   - ☐White
   - ☐Black or African American
   - ☐Asian
   - ☐Other

4. Are you of Hispanic or Latino origin?
   - ☐Yes (Hispanic or Latino origin of any race)
   - ☐No (white alone, not Hispanic or Latino)

5. How many people live in your household
   - ☐1 (I live alone)
   - ☐2
   - ☐3
   - ☐4 or more

6. What is your highest level of educational attainment?
   - ☐Less than a high school degree
   - ☐High school graduate, GED, or other alternative
   - ☐Some college or associates degree
   - ☐Bachelors degree or higher

7. Do you have any disabilities?
   - ☐No, I do not have any disabilities
   - ☐Yes, I have a disability

8. What is your primary language? _____

9. How well do you speak English?
   - ☐Very well
   - ☐Well
   - ☐Poorly

10. What is your current employment status?
   - ☐Employed full time
   - ☐Employed less than full time
   - ☐Unemployed, retired, or otherwise not in the labor force

11. What is your annual household income?
   (including earnings, retirement income, social security income, and other assistance and supplemental income)
   - ☐less than $10,000
   - ☐$10,000 - $20,000
   - ☐$20,000 - $40,000
   - ☐$40,000 - $60,000
   - ☐greater than $60,000

12. What is your housing status?
   - ☐I live in an owner occupied housing unit
   - ☐I live in a renter occupied housing unit

13. What neighborhood do you live in?

_____

Appendix D: Extreme Weather Survey - English translation

Bridgeport Department on Aging *Antioch University New England*

Extreme Weather Survey

Thank you for taking time to complete this survey!
The following questions are intended to help understand the needs and concerns of seniors in relation to extreme weather including storms, floods, heat waves and air pollution. There are 42 questions in the survey and it should take you approximately 8 minutes to complete. Participation is voluntary and you may skip any questions you do not want to answer. Your responses are very important as they will be used in an effort to help make Bridgeport's seniors safer. Your identity will remain confidential. This survey is part of a larger project being facilitated by the City of Bridgeport Department on Aging and Antioch University New England.

If you have any questions about the survey or the project, you can contact Jason Rhoades at: jrhoades@antioch.edu / 603-283-2346

Instructions

Please check the appropriate box to indicate how concerned you are about the following:

The following questions are about receiving adequate warning.

How concerned are you that...	**Unconcerned ⟷ Very Concerned**				
	1	**2**	**3**	**4**	**5**
I will not receive warnings about severe weather (including storms, floods, heat waves, air pollution)	☐	☐	☐	☐	☐
Warnings about extreme weather won't have enough information about what I can do	☐	☐	☐	☐	☐
Warnings will be hard to understand (too fast, print too small, too confusing)	☐	☐	☐	☐	☐
I don't speak English well and warnings will not be in my language	☐	☐	☐	☐	☐

What is your preferred way to receive warnings? _____

What language do you speak best? _____

Please add any other concerns you have about not receiving adequate warning of forecasted extreme weather:

_____

_____

The following questions are about staying safe at home.

How concerned are you that...	Unconcerned ⟷ Very Concerned 1	2	3	4	5
My house may be unsafe in a severe storm and I don't have money or ability to make needed changes	☐	☐	☐	☐	☐
My house will be too hot to stay in during a heatwave and I don't have money to buy/run an air conditioner	☐	☐	☐	☐	☐
My house will be too hot to stay in during days with poor air quality and I don't have money to buy/run an air conditioner or dehumidifier	☐	☐	☐	☐	☐

Please add any other concerns you have about staying safe at home during extreme weather:

_____

_____

The following questions are about your ability to travel.

How concerned are you that...	Unconcerned ⟷ Very Concerned 1	2	3	4	5
There is a lack of public transportation where I live	☐	☐	☐	☐	☐
There is a lack of ride sharing options where I live	☐	☐	☐	☐	☐
Public transportation is too expensive for me to use	☐	☐	☐	☐	☐
There are no transportation options I can afford in an emergency (e.i. taxi, car rental)	☐	☐	☐	☐	☐
It is physically difficult for me to travel	☐	☐	☐	☐	☐
It is hard for me to travel because I need to bring medical equipment and/or medicine with me	☐	☐	☐	☐	☐

What neighborhood do you live in? _____

Please add any other concerns you have about your ability to travel before, during, or after extreme weather:

_____

_____

The following questions are about finding safe shelter in an emergency.

How concerned are you that...	Unconcerned 1	2	3	4	Very Concerned 5
I will not know where a shelter or cooling center is located when I need it	☐	☐	☐	☐	☐
I will have a difficult time getting to a shelter or cooling center	☐	☐	☐	☐	☐
Shelters/cooling centers are unsafe	☐	☐	☐	☐	☐
Shelters/cooling centers are uncomfortable	☐	☐	☐	☐	☐
There are not sufficient shelters/cooling centers in my area	☐	☐	☐	☐	☐
It is difficult for me to stay in a shelter because I need to have specialized medical equipment and/or medicine with me	☐	☐	☐	☐	☐

Please add any other concerns you have about finding safe shelter in a weather related emergency:

_____

_____

The following questions are about getting needed assistance.

How concerned are you that...	Unconcerned 1	2	3	4	Very Concerned 5
No one will check on me to see if I need assistance during or after extreme weather	☐	☐	☐	☐	☐
I will not know what numbers to call for emergencies or problems (i.e. flooding, fire, power outage, sewage back up, injury, feeling ill or unsafe)	☐	☐	☐	☐	☐
I will not be able to leave my building if power is out (i.e. depend on an elevator or chair lift)	☐	☐	☐	☐	☐
During/after a storm, it will be difficult for caregivers to travel to me to provide needed assistance	☐	☐	☐	☐	☐
It will be difficult for me to get medicine or travel to the hospital for services/treatments during or following extreme weather	☐	☐	☐	☐	☐
It will be difficult for me to travel for food and needed supplies during or following extreme weather	☐	☐	☐	☐	☐
If electricity is out for an extended period of time, I won't be able to do essential/critical activities	☐	☐	☐	☐	☐

Please add any other concerns you have about getting needed assistance during or after extreme weather:

The following questions are about recovering after extreme weather.

How concerned are you that...	Unconcerned ⟷ Very Concerned				
	1	**2**	**3**	**4**	**5**
I will have a hard time coping with trauma, stress or anxiety caused by a weather related emergency	☐	☐	☐	☐	☐
If I am injured or sickened by extreme weather, it will be difficult for me to travel to a hospital for treatments.	☐	☐	☐	☐	☐
If I am injured or sickened by extreme weather, it will be difficult to afford medications or treatments.	☐	☐	☐	☐	☐
If I am injured or sickened by extreme weather, it will be difficult for me to do essential daily tasks and I won't have support	☐	☐	☐	☐	☐
If my property is damaged during a storm or there is clean up needed, I will be difficult for me to clean or make needed repairs	☐	☐	☐	☐	☐

Please add any other concerns you have about recovering after extreme weather:

For the following two questions, please check the appropriate box to indicate how strongly you agree or disagree with the statement.

	Strongly Disagree ⟷ Strongly Agree				
	1	**2**	**3**	**4**	**5**
I usually base my decisions about how to respond to forecasted extreme weather on my past experience with similar events	☐	☐	☐	☐	☐
I believe that extreme weather is getting more severe in the Bridgeport area (including extreme heat, storms with heavy precipitation, and/or increased air pollution)	☐	☐	☐	☐	☐

Appendix E: Extreme Weather Survey - Spanish translation

Encuesta Sobre Eventos Climáticos Extremos

¡Muchas gracias por dedicar su tiempo a completar esta encuesta!
Las preguntas que aparecen a continuación, tienen el propósito de ayudar a entender las necesidades y las preocupaciones que tienen las personas mayores (o de la tercera edad) con respecto a eventos climático extremos, que incluyen tormentas, inundaciones, olas de calor y contaminación del aire. La encuesta contiene 42 preguntas, estimamos que podrá responderlas en aproximadamente 8 minutos. Su participación es voluntaria, y Usted puede saltarse cualquier pregunta que no desee responder. Sus respuestas son muy importantes, ya que van a ser consideradas en una iniciativa para ayudar a hacer que las personas mayores de Bridgeport estén más protegidas y seguras en el futuro. Su identidad va a permanecer en forma confidencial. Esta encuesta es parte de un proyecto mayor que se está llevando a cabo bajo el auspicio del Departamento de la Ancianidad de la Ciudad de Bridgeport y la Universidad Antioch New England.

Si Usted necesita más información sobre la encuesta o sobre el proyecto, puede contactar a Jason Rhoades: jrhoades@antioch.edu / 603-499-3505

Instrucciones

Por favor, marque en el casillero correspondiente su grado de preocupación o alarma sobre lo siguiente:

Las siguientes preguntas se refieren a recibir un aviso en forma adecuada.

¿Qué tan preocupado/a está Usted de que ...	**No Preocupado** 1	2	3	4	**Muy Preocupado** 5
no recibiré avisos sobre condiciones climáticas severas (incluyendo tormentas, inundaciones, olas de calor, contaminación del aire)?	☐	☐	☐	☐	☐
los avisos sobre eventos climáticos extremos no tendrán suficiente información sobre lo que yo pueda hacer al respecto?	☐	☐	☐	☐	☐
los avisos serán difíciles de entender (muy rápidos, impresos en letras muy pequeñas, demasiado confusos)?	☐	☐	☐	☐	☐
Yo no hablo bien el inglés, y los avisos no serán emitidos en mi idioma?	☐	☐	☐	☐	☐

¿Cuál es su formato o modo preferido para recibir los avisos? _____

¿Cuál es el idioma que Usted habla mejor? _____

Por favor, escriba abajo cualquier otra preocupación que Usted tenga en relación a recibir los avisos adecuadamente:

_____

_____

Las siguientes preguntas se refieren a permanecer seguro/a o confortable en su casa.

¿Qué tan preocupado/a está Usted de que ...	No Preocupado 1	2	3	4	Muy Preocupado 5
Mi casa puede **no** ser segura en una situación de tormenta severa, y yo no tengo el dinero o la habilidad para hacer los arreglos necesarios (para hacer mi casa más segura)	☐	☐	☐	☐	☐
Mi casa se va a tornar muy caliente como para estar en ella durante una ola de calor, y yo no tengo el dinero para comprar o para hacer funcionar un sistema de aire acondicionado.	☐	☐	☐	☐	☐
Mi casa estará muy caliente como para estar en ella durante los días con una pobre o deteriorada calidad del aire, y yo no tengo el dinero para comprar o para hacer funcionar un sistema de aire acondicionado.	☐	☐	☐	☐	☐

Por favor, escriba abajo cualquier otra preocupación que Usted tenga en relación a sentirse seguro/a o confortable en su casa:

_____

_____

Las siguientes preguntas son acerca de su habilidad para viajar.

¿Qué tan preocupado/a está Usted de que ...	No Preocupado 1	2	3	4	Muy Preocupado 5
Haya falta de transporte público donde yo vivo	☐	☐	☐	☐	☐
Haya falta de opciones de transporte compartido (*carpool*) donde yo vivo	☐	☐	☐	☐	☐
El transporte público es demasiado costoso o caro para mí	☐	☐	☐	☐	☐
No hay opciones de transporte que yo pueda pagar (o al alcance de mi poder adquisitivo) en caso de emergencia (como taxi, automóviles para rentar)	☐	☐	☐	☐	☐
Viajar es físicamente difícil para mí	☐	☐	☐	☐	☐
Viajar es duro o dificil para mí porque necesito llevar conmigo equipamiento médico y/o medicamentos	☐	☐	☐	☐	☐

¿En qué vecindario vive Usted? _____

Por favor, escriba abajo cualquier otra preocupación que Usted tenga en relación a su habilidad de viajar:

_____

_____

Las siguientes preguntas se refieren a conseguir la asistencia que Usted necesita.

¿Qué tan preocupado/a está Usted de que ...	**No Preocupado** ⟷ **Muy Preocupado**				
	1	**2**	**3**	**4**	**5**
Nadie se va a ocupar de mí y verificar si yo necesito atención durante o después de un evento climático severo.	☐	☐	☐	☐	☐
No sabré a cuáles números debo llamar en caso de emergencias o problemas (por ejemplo, en caso de inundaciones, incendios, cortes de electricidad, desborde de alcantarillas o agua residuales, lesiones o lastimaduras, enfermedad, o si no me siento a salvo)	☐	☐	☐	☐	☐
No seré capaz de salir de mi edificio en caso de un corte de electricidad (por ejemplo, dependo de un elevador, o de una telesilla o montacargas)	☐	☐	☐	☐	☐
Durante o después de una tormenta, va a ser difícil que las personas que me cuidan puedan viajar hasta donde yo esté, para atenderme	☐	☐	☐	☐	☐
Será difícil para mí obtener medicamentos o viajar hacia el hospital para recibir servicios/tratamientos, durante o luego de un evento climático extremo.	☐	☐	☐	☐	☐
Será difícil para mí viajar para adquirir alimentos y otros elementos necesarios, durante o luego de un evento climático extremo.	☐	☐	☐	☐	☐
Si falta la electricidad por un tiempo prolongado, no seré capaz de realizar actividades esenciales/críticas.	☐	☐	☐	☐	☐

Por favor, escriba abajo cualquier otra preocupación que Usted tenga en relación a obtener la asistencia que Usted necesita durante o después de una evento climático extremo:

_____

_____

Las siguientes preguntas se relacionan con su posibilidad de hallar un refugio seguro en caso de emergencia.

¿Qué tan preocupado/a está Usted de que ...	No Preocupado 1	2	3	4	Muy Preocupado 5
No sabré dónde está localizado el refugio o el centro con aire acondicionado, cuando los necesite	☐	☐	☐	☐	☐
Tendré dificultades para poder llegar al refugio o a centro con aire acondicionado	☐	☐	☐	☐	☐
Los refugios/centros con aire acondicionado **no** son seguros	☐	☐	☐	☐	☐
Los refugios/centros con aire acondicionado **no** son confortables	☐	☐	☐	☐	☐
No hay suficientes refugios/centros con aire acondicionado en mi área.	☐	☐	☐	☐	☐
Es difícil para mí permanecer en un refugio porque yo necesito tener conmigo equipamiento médico especial y/o medicamentos.	☐	☐	☐	☐	☐

Por favor, escriba abajo cualquier otra preocupación que Usted tenga en relación a hallar un refugio seguro en caso de emergencia:

_____

_____

Las siguientes preguntas se relacionan con su recuperación después de un evento climático extremo.

¿Qué tan preocupado/a está Usted de que ...	No Preocupado 1	2	3	4	Muy Preocupado 5
Tendré dificultades para afrontar el trauma y el estrés luego de una situación de emergencia climática?	☐	☐	☐	☐	☐
Si resulto lastimado o enfermo debido a un evento climático extremo, será difícil para mí viajar a un hospital para recibir tratamientos.	☐	☐	☐	☐	☐
Si resulto lastimado o enfermo debido a un evento climático extremo, me será difícil poder pagar el costo de medicamentos o tratamientos.	☐	☐	☐	☐	☐
Si resulto lastimado o enfermo debido a un evento climático extremo, me será difícil realizar tareas diarias esenciales y yo **no** recibo ninguna ayuda	☐	☐	☐	☐	☐
Si mi propiedad es dañada durante una tormenta, o si es necesario realizar tareas de limpieza, no estaré en condiciones de limpiar o de realizar las reparaciones necesarias.	☐	☐	☐	☐	☐

Por favor, escriba abajo cualquier otra preocupación que Usted tenga en relación a su recuperación después de un evento climático extremo:

_____

_____

En las siguientes dos preguntas, por favor marque en el casillero apropiado para indicar qué tan de acuerdo o en desacuerdo está Usted:

	Totalmente en Desacuerdo ⟷ Concuerdo Totalmente				
	1	**2**	**3**	**4**	**5**
Mis decisiones sobre cómo responder a eventos climáticos extremos pronosticados, están basadas en mis experiencias anteriores con eventos similares	☐	☐	☐	☐	☐
Yo creo que los eventos climáticos extremos se están tornando más severos en el área de Bridgeport (incluyendo el calor extremo, las tormentas con precipitaciones intensas, y/o una creciente contaminación del aire)	☐	☐	☐	☐	☐

Appendix F: Summative evaluation questionnaire

Climate Resilient Seniors

Final Evaluation

Thank you for taking the time to complete this survey. Your answers will be anonymous and will help improve our efforts to keep seniors safe from the impacts of extreme weather. There are 7 questions and it will take approximately 5 minutes to complete. Participation is voluntary and you may skip any questions you do not want to answer. For questions, contact Jason Rhoades at: jrhoades@antioch.edu/603-283-2346

Instructions: *For questions 1 through 5, please check the appropriate box to indicate how strongly you agree or disagree with the following statements.*

	Strongly Disagree ⟷ **Strongly Agree**				
	1	**2**	**3**	**4**	**5**
1. The recommendations of this project reflect the concerns and needs of the elderly.	☐	☐	☐	☐	☐
2. The recommendations of this project will help make seniors in Bridgeport safer.	☐	☐	☐	☐	☐
3. As a result of this project, I am more aware of how changes in extreme weather may affect the seniors in Bridgeport.	☐	☐	☐	☐	☐
4. As a result of this project, I am more knowledgeable about how to protect myself from the impacts of extreme weather.	☐	☐	☐	☐	☐
5. As a result of this project, I am better able to advocate for what I need to stay safe during extreme weather.	☐	☐	☐	☐	☐

Appendix G: Summative evaluation interview protocol

Summative Evaluation Interview Protocol

For all participants (including elderly community members and attending city staff):

1. If you think this project will help keep Bridgeport's seniors safer from extreme weather, what aspects of the project contributed to its success?

2. What were the primary challenges that made the project difficult? How were they addressed?

Additional questions for city staff:

3. To what degree do you think the recommendations of the project will be implemented and be integrated with the city's ongoing efforts?

4. What contributed to its implementability?

5. Did the project increase awareness of and focus on the vulnerability of the elderly to climate change among elderly support groups and city agencies?

6. Did the project lead to increased communication among elderly support groups and relevant city agencies?

Appendix H. Raw results from the vulnerability assessment meetings

	Extreme Heat and Heat Waves	Flooding and Storms	Air pollution and allergens
Current impacts of stressor	Stay Inside	Difficulty driving to run errands and do tasks	Difficulty breathing
	Irritability	Difficulty travelling (caregivers can't access patients, difficulty doing essential tasks)	Difficulty sleeping
	Breathing difficulty, discomfort	Difficulty finding safe shelter	Depression
	Anxiety	Damage to home (flooding, winds damaging siding, roofing, bringing down limbs)	General pain/discomfort
	Health issue, illness, hospitalization	Impacts of physical health (injury during storm, health impacts from damage to home such as sewage or mold)	Staying inside/isolation
	Isolation	Impacts to emotional health (trauma, stress)	Travelling to hospital
	Trouble running errands/getting medications and groceries, medical treatment	Damage to property	
		Loss of electricity (no refrigeration, no cooking, no heating, can't run medical machines, elevators don't work)	

	Extreme Heat and Heat Waves	Flooding and Storms	Air pollution and allergens
Factors contributing to vulnerability	Not enough cooling centers (*need adequate cooling centers)*	Lack of money to own a car, ride the bus, pay for transportation (*transportation needs to be affordable)*	Health problems (asthma, lung infection, COPD)
	Lack of awareness about available cooling centers and other resources (*seniors need to be aware of resources)*	Lack of money to pay for a place to stay	Lack of awareness about where to get help (*seniors need to be aware of resources*)
	Lack of awareness about where to get help (*seniors need to be aware of resources*)	Don't know where to get medication during a storm or emergency (*seniors need to be aware of resources*)	Lack of transportation options
	Underlying health problems (diabetes)	Lack of information on the location of emergency shelters (*seniors needs to be aware of resources*)	Isolation (might not receive warnings)
	Lack of transportation options (*transportation needs to take seniors to grocery stores, shelters, cooling centers, clinics, and hospitals*	Lack of information on how to get to emergency shelters (*seniors need to be aware of resources*)	Disabilities
	Difficult for seniors living alone, especially seniors who can't call family or friends nearby	Lack of information about who to call to help with clean up, recovery (*seniors need to be aware of resources*)	Lack of air conditioning (can't afford it)
	More difficult for handicapped (wheelchair)	Don't speak English so don't know about warnings, information, resources (*resources need to be accessible)*	
	No air conditioning, no way to keep cool (can't afford it)	Accessibility of shelters (*need adequate and accessible shelters that can accommodate the special needs of seniors*)	Difficulty understanding/navigating existing resources (*resources need to be simple to find and navigate*)
	Don't receive warnings due to isolation, not on technology, don't speak English (*warnings need to use appropriate technology and be in multiple languages)*	Alzheimer's makes it difficult to understand warnings, respond in emergency, access resources during and after (*warnings need to be in clear language, understandable by seniors with a range of cognitive and sensory capacities with relevant information to seniors*	No money to pay for dehumidifiers or air conditioner
	Low income (working part time or retired)	Lack of money to pay for improvements or repairs (limited income, poor credit, little savings)	Lack of mental health resources
		Difficult for disabled to travel (especially in emergency), hard to get medical treatments	Difficult to travel to the hospital, pay for medications
		low income, lack of education - marginalized	
		Poor hearing (don't understand warnings)	
		health conditions (dependent on caregiver)	
		Lack of family or friends to help prepare or cope	
		Can't drive, have trouble driving due to disability, bad eye sight	
		Need special accommodations due to disability or medical equipment	
		Hard to drive in bad weather	
		Difficult to bring medical equipment on public transportation (*transportation needs to accommodate individuals with disabilities/specialized equipment or supplies)*	

	Extreme Heat and Heat Waves	Flooding and Storms	Air pollution and allergens
Approaches used to prepare for, cope with, or recover from stressor	Staying inside (*leads to increased isolation, can't run errands*)	Have to stay in a motel (*costs money*)	Staying inside (*leads to isolation, can't do tasks outside of house*)
	Running AC (*but costs money*)	Paying for clean up and repairs (*costs money*)	Close windows and run AC (*costs money*)
	Take cool shower	Stay with family or friends (*not an option for people without family or friends nearby*)	Travelling to hospital to see the doctor (*costs money, takes time, mentally and physically fatiguing*)
	Dress with light clothes		Using a breathing machine (*costs money, can't leave house*)
	Drink plenty of fluids		
	Close blinds		
	Eat light foods		
	No exercise that day		
	Seek medical treatment (difficult to travel)		

Impacts of predicted climate changes
Unaffected seniors become affected but lack preparation and knowledge, putting them more at risk
Impacts exceed seniors' previous experience. Their previous strategies become insufficient leaving them unprepared.
Impacts overwhelm seniors coping capacity (cost too much money, too emotionally or physically taxing)
Seniors underestimate severity of future events and underprepare. Seniors may plan based on past events leaving themselves underprepared for extreme events.

Appendix I: Raw Extreme Weather Survey results

Extreme Weather Survey Results

	Unconcerned				Very concerned		
Receiving Adequate Warning	**1**	**2**	**3**	**4**	**5**	**Average**	**% Highly Concerned (4 or 5)**
Won't receive warning	14	23	42	16	63	**3.58**	**0.50**
Warning won't have enough info	12	20	29	35	64	**3.74**	**0.62**
Warning will be hard to understand	22	17	36	20	57	**3.48**	**0.51**
Warning won't be in my language	96	11	14	4	23	**1.97**	**0.18**

Staying Safe at Home	**1**	**2**	3	**4**	**5**	**Average**	**% Highly Concerned (4 or 5)**
My house is unsafe and can't afford to fix	30	21	36	26	51	**3.29**	**0.47**
Can't afford to run ac in heat wave	50	33	20	19	38	**2.76**	**0.36**
Can't afford to run AC in air pollution	59	30	15	19	38	**2.67**	**0.35**

Having Adequate Transportation Resources	**1**	**2**	3	**4**	**5**	**Average**	**% Highly Concerned (4 or 5)**
Lack of public transportation where I live	59	20	26	21	21	**2.49**	**0.29**
Lack of ride sharing where I live	48	11	30	23	34	**2.89**	**0.39**
Public transport is too expensive	62	8	32	14	22	**2.46**	**0.26**
Can't afford transportation in emergency	60	24	25	7	34	**2.54**	**0.27**
It is physically difficult for me to travel	64	23	34	14	15	**2.29**	**0.19**
It is hard to travel because of equip needs or medicine	71	22	24	9	13	**2.07**	**0.16**

Finding Safe Shelter	**1**	**2**	3	**4**	**5**	**Average**	**% Highly Concerned (4 or 5)**
Don't know where shelter is located	34	22	26	27	26	**2.92**	**0.39**
Hard for me to get to shelter	40	26	17	32	38	**3.01**	**0.46**
Shelters are unsafe	37	19	28	20	47	**3.14**	**0.44**
Shelters are uncomfortable	34	23	32	15	44	**3.08**	**0.40**
There are not enough shelters	29	14	20	28	55	**3.45**	**0.57**
Hard for me to stay in shelter because of equip needs or medicine	56	24	21	18	22	**2.48**	**0.28**

Getting Needed Assistance	1	2	3	4	5	Average	% Highly Concerned (4 or 5)
No one will check on me during or after extreme weather	22	36	36	14	26	**2.90**	**0.30**
Don't know emergency numbers	44	26	24	24	34	**2.86**	**0.38**
Won't be able to leave my building if power is out	72	24	22	6	22	**2.19**	**0.19**
Will be difficult for caregivers to reach me in storm	54	18	30	22	26	**2.65**	**0.32**
Will be difficult to get to hospital or get medicine during or after extreme weather	32	26	28	26	38	**3.08**	**0.43**
Will be difficult to get food and supplies during or after extreme weather	28	24	30	26	46	**3.25**	**0.47**
If electricity is out, will be difficult to do essential activities	22	22	32	20	58	**3.45**	**0.51**

Having Resource to Aid in Recovery	1	2	3	4	5	Average	% Highly Concerned (4 or 5)
Difficulty coping with trauma and stress	24	31	27	9	38	**3.05**	**0.36**
Difficult to travel to hospital for treatment if injured or sickened	24	29	31	30	45	**3.27**	**0.47**
Difficult to afford medication or treatment if injured or sickened	34	23	41	20	30	**2.93**	**0.34**
Won't have needed support to do daily tasks if injured or sickened if injured or sickened	34	18	49	17	30	**2.94**	**0.32**
Difficult to do clean up or repairs to property	38	18	22	16	53	**3.19**	**0.47**

Appendix J: Raw impact and feasibility rankings

Elderly Participants

Adaptation Recommendation		Low 1	2	3	4	High 5	AVG
1. Provide emergency preparedness trainings specifically for seniors	Impact	0	1	2	5	26	**4.6**
	Feasibility	0	0	14	6	13	**4.0**
2. Develop and distribute emergency preparedness informational materials specifically for seniors.	Impact	0	1	4	0	30	**4.7**
	Feasibility	0	2	6	10	15	**4.2**
3. Conduct a reverse 911 sign up drive targeted at seniors.	Impact	2	0	2	4	23	**4.5**
	Feasibility	2	0	8	4	15	**4.0**
4. Tailor warnings to meet seniors' needs.	Impact	0	0	4	4	23	**4.6**
	Feasibility	0	0	6	4	21	**4.5**
5. Tailor shelters to meet seniors' needs.	Impact	0	2	5	5	18	**4.3**
	Feasibility	2	1	8	4	15	**4.0**
6. Promote volunteer ridesharing and transportation assistance.	Impact	2	2	4	5	17	**4.1**
	Feasibility	4	0	12	0	14	**3.7**
7. Establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors.	Impact	2	0	4	0	25	**4.5**
	Feasibility	2	0	6	5	18	**4.2**

City Staff

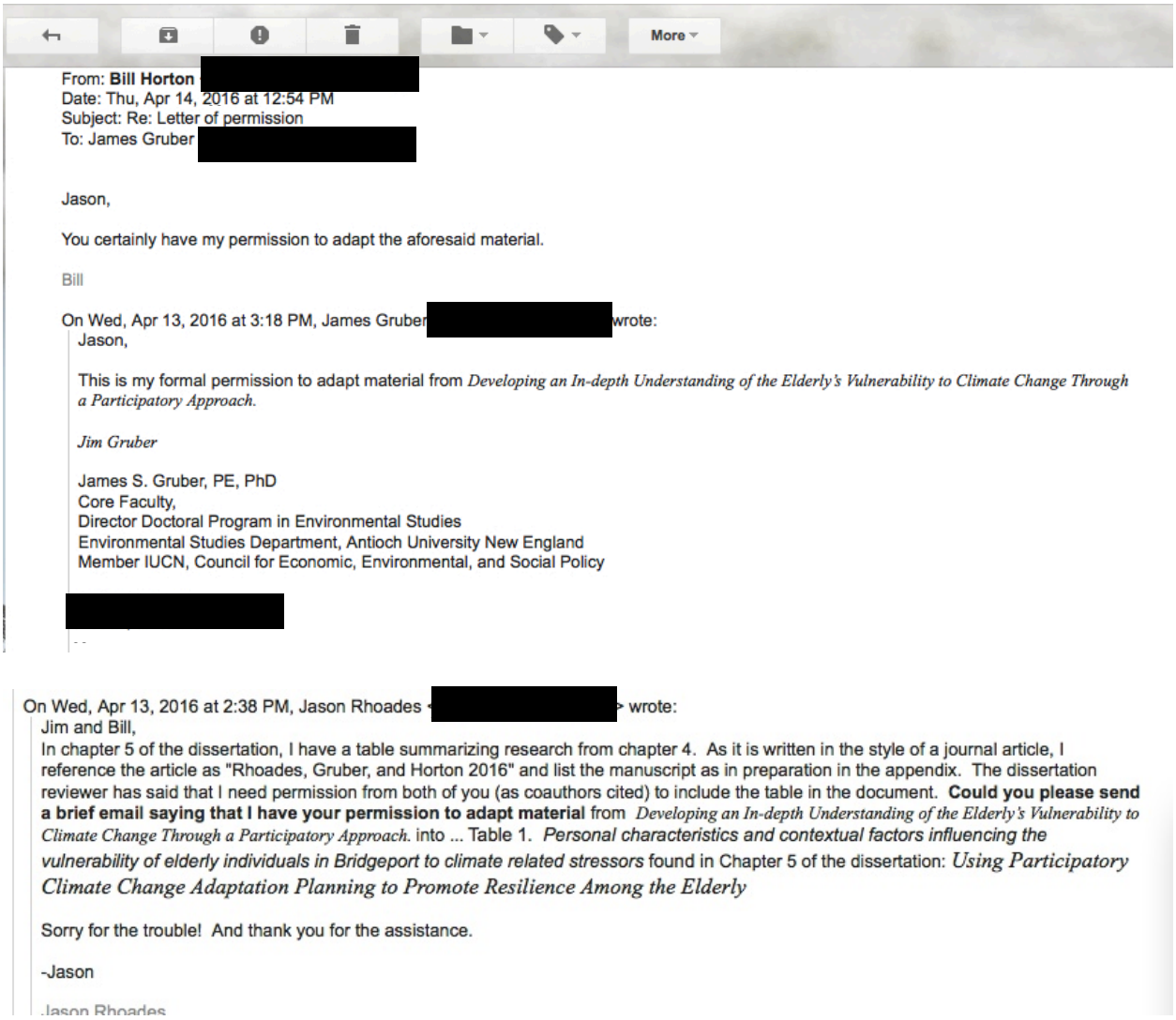
Adaptation Recommendation		Low 1	2	3	4	High 5	AVG
1. Provide emergency preparedness trainings specifically for seniors	Impact	0	0	0	2	5	**4.7**
	Feasibility	0	0	2	5	0	**3.7**
2. Develop and distribute emergency preparedness informational materials specifically for seniors.	Impact	0	0	0	0	7	**5.0**
	Feasibility	0	0	1	3	3	**4.3**
3. Conduct a reverse 911 sign up drive targeted at seniors.	Impact	0	0	1	3	3	**4.3**
	Feasibility	0	0	4	2	1	**3.6**
4. Tailor warnings to meet seniors' needs.	Impact	0	0	0	2	5	**4.7**
	Feasibility	0	0	0	2	5	**4.7**
5. Tailor shelters to meet seniors' needs.	Impact	0	0	1	3	3	**4.3**
	Feasibility	0	0	1	2	4	**4.4**
6. Promote volunteer ridesharing and transportation assistance.	Impact	0	0	1	2	2	**4.2**
	Feasibility	0	0	1	1	3	**4.4**
7. Establish a telephone-based clearinghouse for extreme weather/emergency resources for seniors.	Impact	0	0	0	3	4	**4.6**
	Feasibility	0	0	0	2	5	**4.7**

Appendix K: Raw summative evaluation Likert scale survey data

	Strongly Disagree				Strongly Agree	
Evaluation Statements	**1**	**2**	**3**	**4**	**5**	**AVG**
The recommendations of this project reflect the concerns and needs of the elderly.	0	0	0	0	35	**5.0**
The recommendations of this project will help make Bridgeport's seniors safer.	0	0	0	0	35	**5.0**
As a result of this project, I am more aware of how changes in extreme weather may affect seniors in Bridgeport.	0	0	0	0	35	**5.0**
As a result of this project, I am more knowledgeable about how to protect myself from the impacts of extreme weather.	0	0	3	5	27	**4.7**
As a result of this project, I am better able to advocate for what I need to stay safe during extreme weather.	0	0	3	6	26	**4.7**

Appendix L: Permissions

Permission letters for Table 1 in Chapter 5.



More

From: **Bill Horton** [redacted]
Date: Thu, Apr 14, 2016 at 12:54 PM
Subject: Re: Letter of permission
To: James Gruber [redacted]

Jason,

You certainly have my permission to adapt the aforesaid material.

Bill

On Wed, Apr 13, 2016 at 3:18 PM, James Gruber [redacted] wrote:

> Jason,
>
> This is my formal permission to adapt material from *Developing an In-depth Understanding of the Elderly's Vulnerability to Climate Change Through a Participatory Approach.*
>
> *Jim Gruber*
>
> James S. Gruber, PE, PhD
> Core Faculty,
> Director Doctoral Program in Environmental Studies
> Environmental Studies Department, Antioch University New England
> Member IUCN, Council for Economic, Environmental, and Social Policy
>
> [redacted]

On Wed, Apr 13, 2016 at 2:38 PM, Jason Rhoades [redacted] wrote:

> Jim and Bill,
> In chapter 5 of the dissertation, I have a table summarizing research from chapter 4. As it is written in the style of a journal article, I reference the article as "Rhoades, Gruber, and Horton 2016" and list the manuscript as in preparation in the appendix. The dissertation reviewer has said that I need permission from both of you (as coauthors cited) to include the table in the document. **Could you please send a brief email saying that I have your permission to adapt material** from *Developing an In-depth Understanding of the Elderly's Vulnerability to Climate Change Through a Participatory Approach.* into ... Table 1. *Personal characteristics and contextual factors influencing the vulnerability of elderly individuals in Bridgeport to climate related stressors* found in Chapter 5 of the dissertation: *Using Participatory Climate Change Adaptation Planning to Promote Resilience Among the Elderly*
>
> Sorry for the trouble! And thank you for the assistance.
>
> -Jason
>
> Jason Rhoades