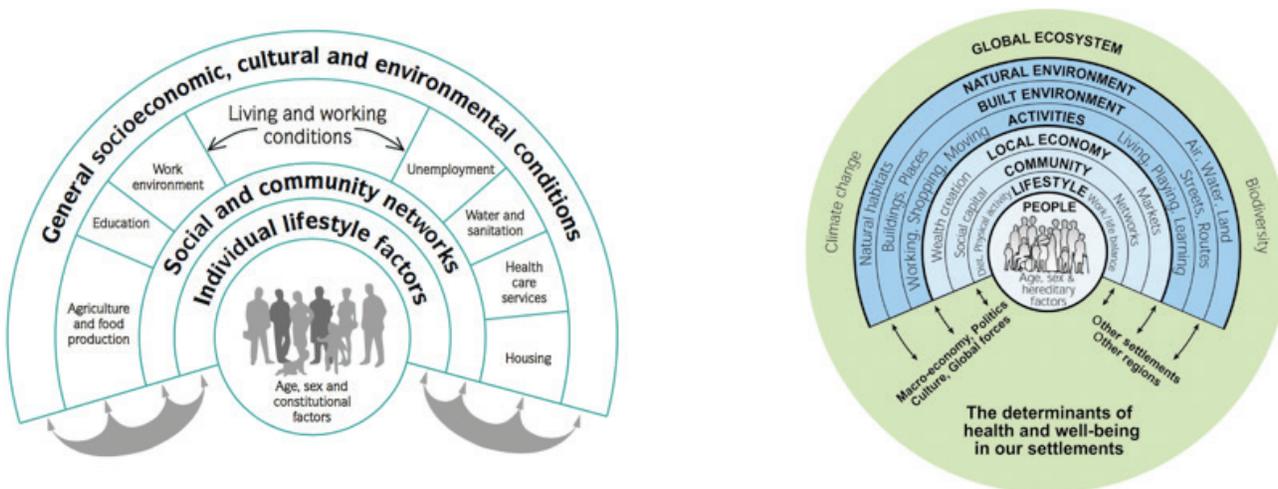


## Appendix 1: Development of Climate, Health, and Equity Framework

A number of well-established frameworks informed the development of the climate, health, and equity framework included in Section 2 of this Guide (see Figure 2.1.1). For a more complete version of this framework, see Figure A 1.4. In recent years, LHDs have recognized the need to address the social determinants of health in order to eliminate health inequities. The oft-cited social determinants “rainbow” (Figure A1.1) emphasizes the interactions among layers of health determinants: “individual lifestyles are embedded in social norms and networks, and in living and working conditions, which in turn are related to the wider socioeconomic and cultural environment.”<sup>1</sup> Barton and Grant<sup>2</sup> expand on the social determinants rainbow (Whitehead and Dahlgren, 1991) to show how the natural environment and planetary ecosystems interface with other determinants of health. Climate change and other changes in the global ecosystem have significant impacts on the natural and built environments, and on economies, communities, and people. At the same time, individuals and communities experience the impacts of climate change in the context of their lived experience, current living conditions, assets and resources, and opportunities for health and well-being, all of which contribute to climate vulnerability and climate resilience, as described later in this section. The circle on the right in Figure A1.1 conveys the core message underlying this Guide: We cannot achieve healthy people and healthy places on an unhealthy planet, and fostering a healthy planet can do much to promote health and equity.<sup>1</sup>

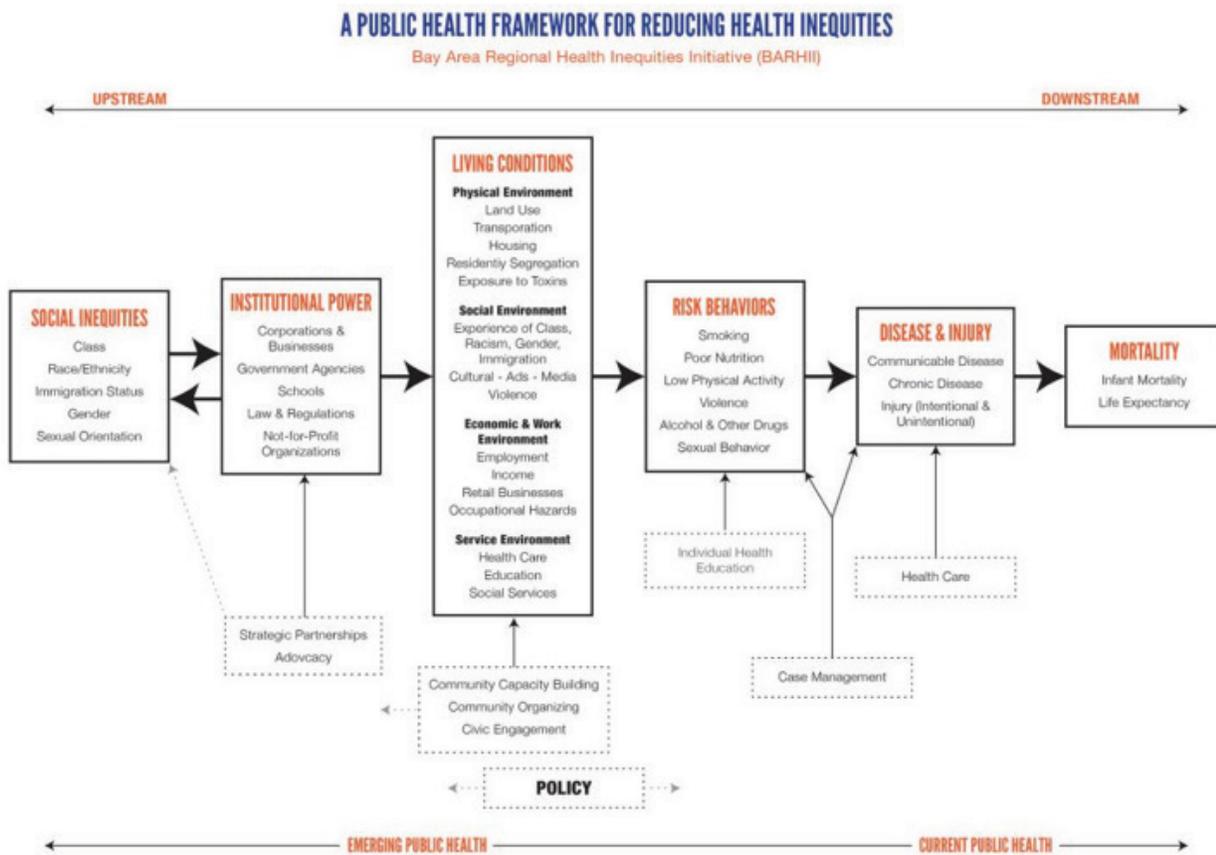
**Figure A1.1:** Social Determinants of Health “rainbow,” Barton and Grant, 2006 developed from a concept by Whitehead and Dahlgren, 1991



<sup>1</sup> Climate change acts in concert with other significant disruptions to the Earth’s natural systems, such as habitat and biodiversity loss, soil degradation, toxic chemical pollution, and unsustainable water use. Many of these global ecosystem changes—including climate change—result from exploitation and excessive consumption of natural resources, combined with population growth. The emerging discipline of “planetary health,” explores the full range of ecosystem degradation on human health.

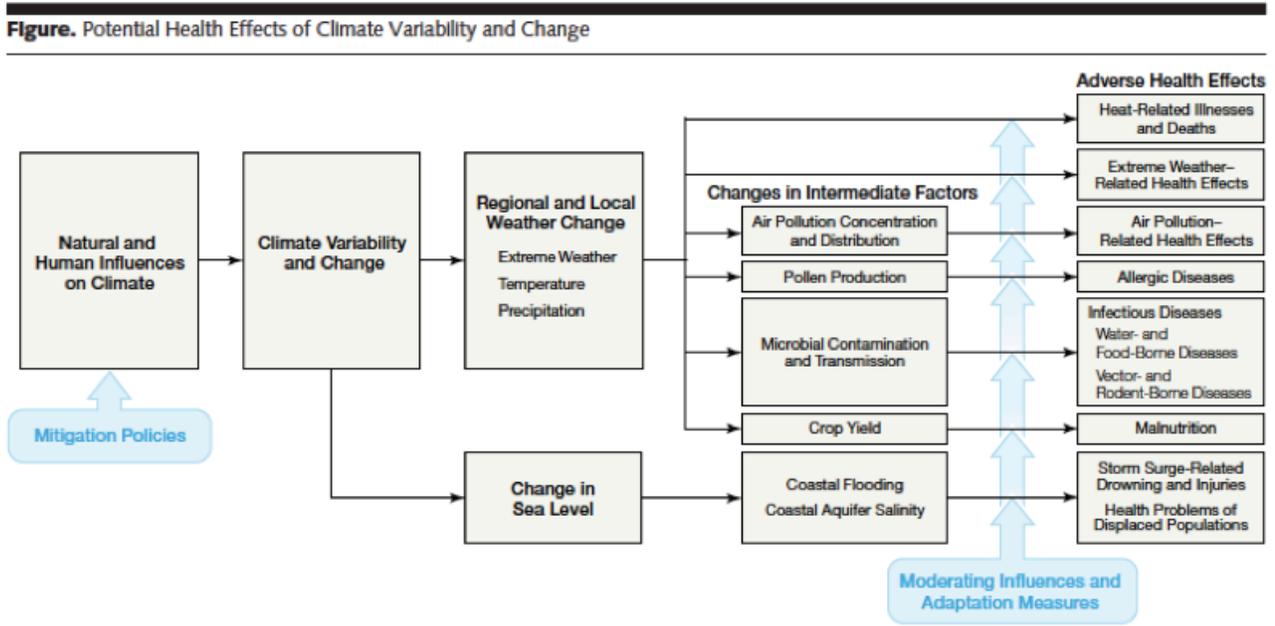
In Figure A1.2, the Bay Area Regional Health Inequities Initiative framework highlights that there are *structural mechanisms* that shape the physical, social, working, economic, and services environments in which we live, work, study, and play. Structural mechanisms are defined by the World Health Organization as “those that generate stratification and social class divisions in the society and that define individual socioeconomic position within hierarchies of power, prestige and access to resources...[and] are rooted in the key institutions and processes.”<sup>3</sup>

**Figure A1.2:** The Bay Area Regional Health Inequities Initiative framework

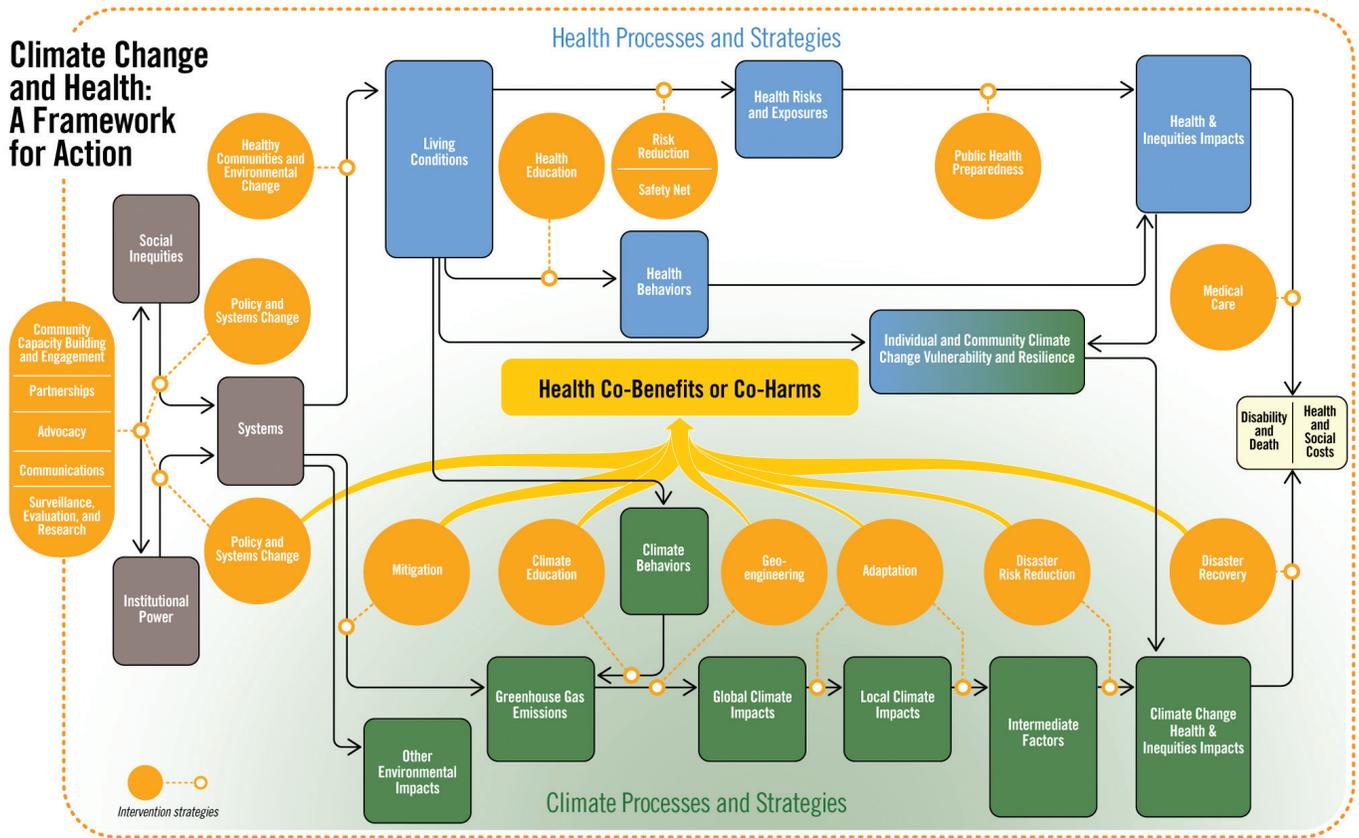


Patz<sup>4</sup> and others have published conceptual frameworks that depict the pathways through which climate change impacts health (Figure A1.3). For additional frameworks from the Lancet Commission and U.S. Global Change Research Program, see Appendix 2.

**Figure A1.3:** Potential health effects of climate variability and change



**Figure A1.4:** Climate Change and Health: A Framework for Action



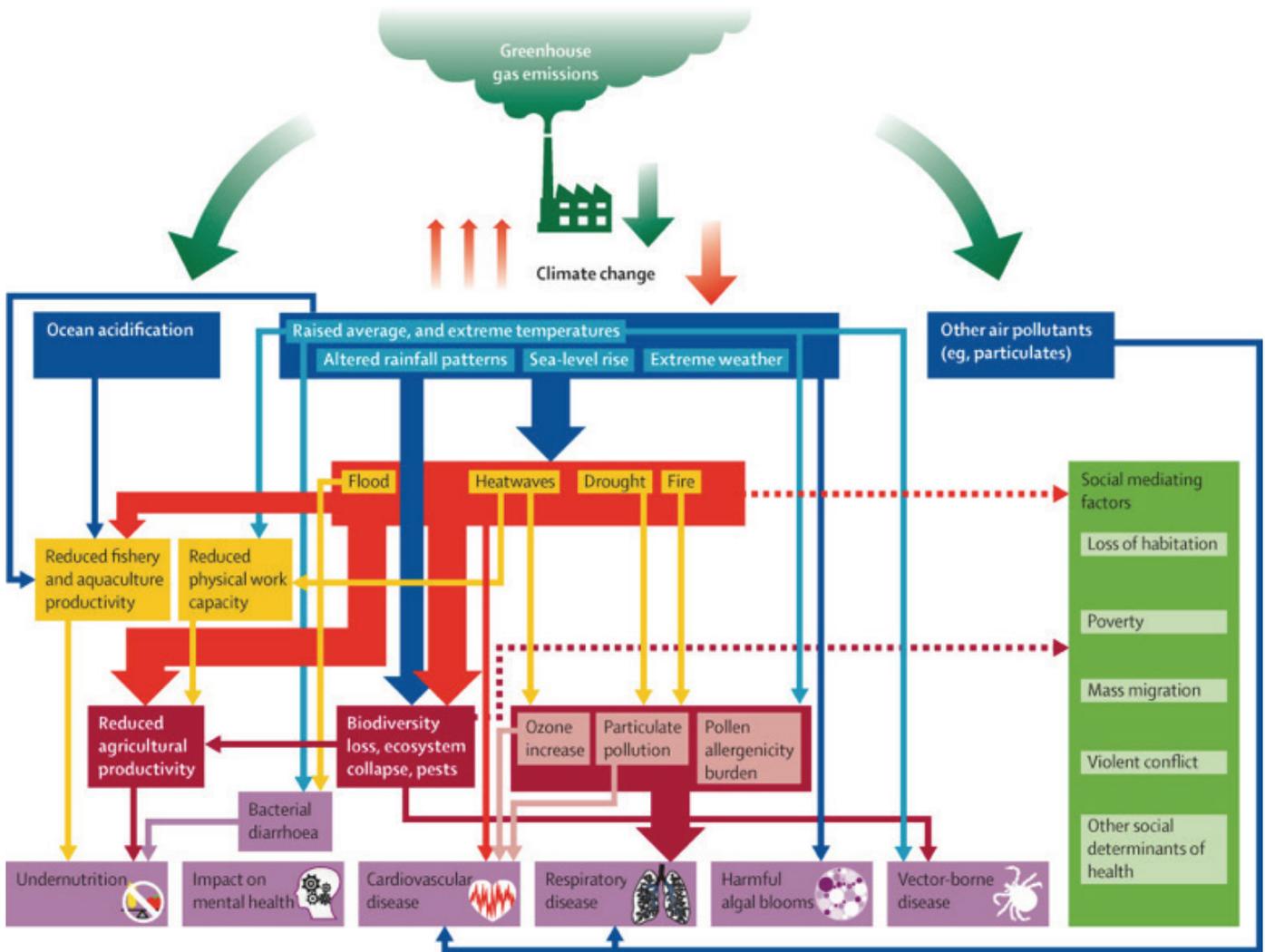
Developed by the Public Health Institute's Center for Climate Change & Health. © Public Health Institute 2014

See the live [Climate Change and Health: A Framework for Action](#) for more information.

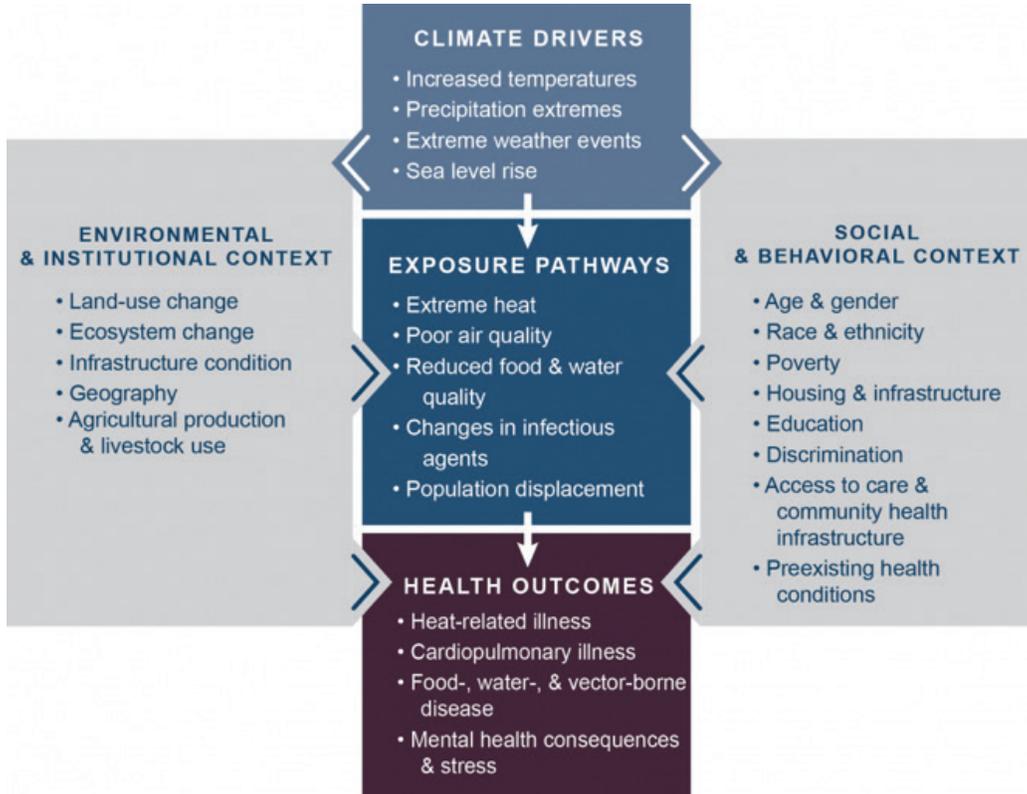
## Appendix 2: Additional Climate and Health Frameworks

Following are two climate and health frameworks. The first (Figure A2.1) is from the Lancet Commission. Figure A2.2 is a framework from the U.S. Global Change Research Program,.

**Figure A2.1:** The Lancet’s climate and health model 5



**Figure A2.2:** U.S. Global Change Research Programs’ climate and health model<sup>5</sup>



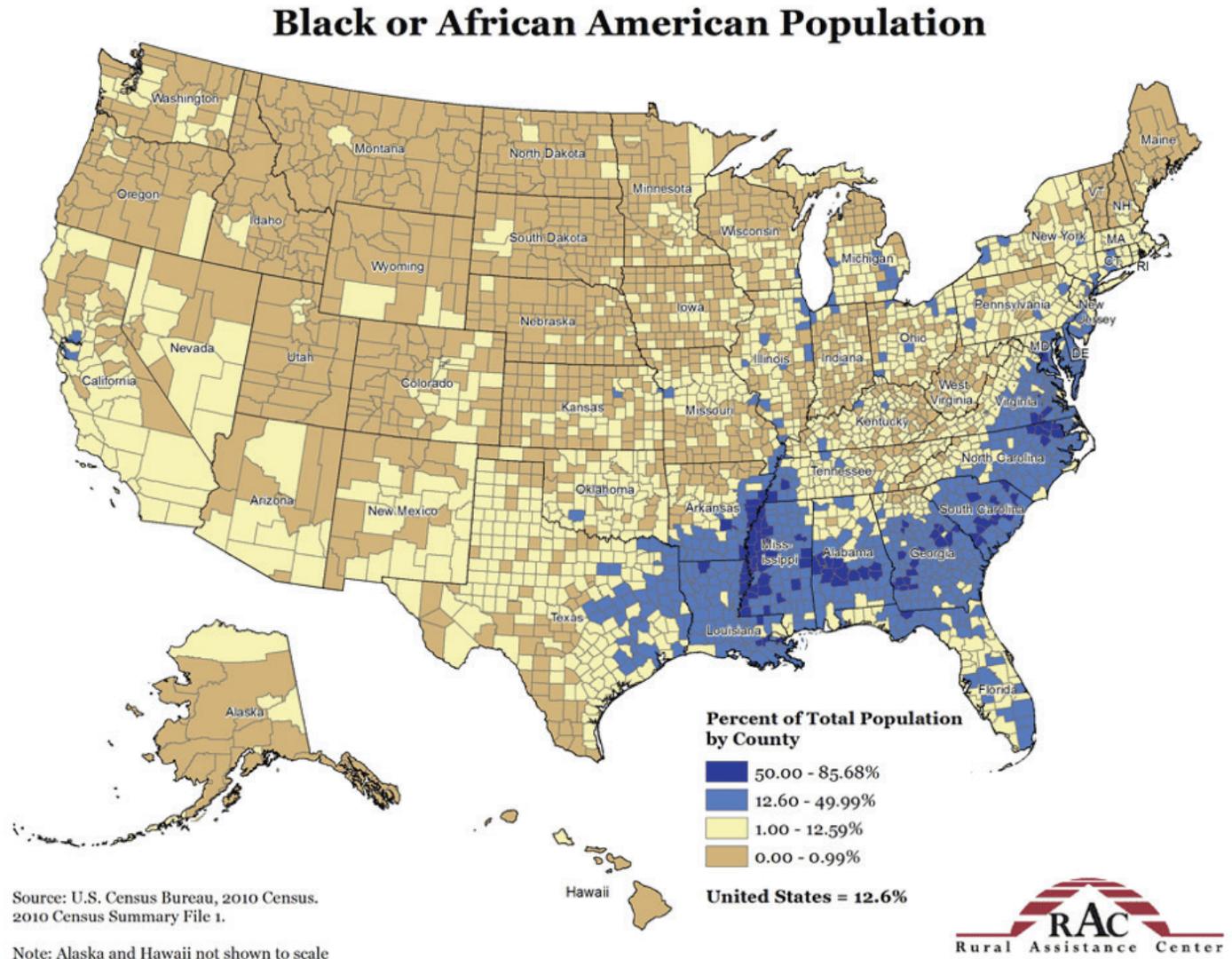
## Appendix 3: Climate Impacts on Communities of Color

### A3.1: African Americans, Climate Change, and Health

#### African Americans in the United States

As of 2016, there were over 42 million individuals who identify as African American in the United States, making up 13.3% of the population. This number grows to over 46 million (14.5% of the population) when those identifying as African American and another race are included.<sup>6</sup> Washington D.C. and the Southern states of Mississippi, Georgia, and Louisiana have the highest percentage of individuals identifying as African American as part of their total populations.<sup>7</sup> (Figure A3.1.1).

Figure A3.1.1: African American population in the United States



## Social Determinants of Health and Health Equity

Present-day African American communities have lower income, less education, and poorer health status than non-Hispanic White communities overall, largely due to historical discriminatory practices in housing, education, employment, and healthcare.

### Historical Influences

- **Slavery** – As far back as the 1600s, slavery of African and African American people was a precursor to more recent discriminatory policies and current day inequities due to the social, political, and economic divide it caused between African American and White populations.<sup>8</sup>
- **Jim Crow Laws** – In the late 1800s and early 1900s, Jim Crow laws enforced racial segregation and reserved the best educational, health, and social opportunities for Whites. This furthered resource and power divide between African Americans and White communities that endure to the present and impact health outcomes and healthcare access.<sup>9</sup>
- **Redlining** – In the 1930s, banks would deny loans to people of color in well-maintained and higher income neighborhoods, leading to residential segregation that hindered African Americans and other people of color from home ownership.<sup>10</sup> Present-day institutionalized racism towards African Americans still exists in subtle but similar mortgage lending policies and continues to perpetuate the social stratification of ethnic groups.

### Key Social Determinants

Historical policies have led to present-day social and health inequities in African Americans that impact climate vulnerability and resilience:

- **Health care** – African Americans are less likely than non-Hispanic Whites to receive appropriate medical treatment when needed, even if they have the same coverage and access to care. This means lower access to treatment for climate-related health impacts such as heat stroke, exacerbated asthma, and injuries from extreme weather events.<sup>11</sup>
- **Neighborhoods** – Residential segregation has led to a disproportionate amount of African Americans in neighborhoods with greater physical hazards, such as air pollution; social hazards, such as lack of food access; and fewer resources, such as green spaces.<sup>12</sup> Data also shows that a higher percentage of African Americans reside in areas with low tree canopy coverage and a high amount of heat-trapping surfaces. This decreases their access to shady areas in hot weather and increasing neighborhood temperature due to the urban heat island effect.<sup>13</sup>
- **Poverty** – One out of five of African American families are in poverty, compared to one out of fifteen White families. These households have a smaller cushion against property damage or injuries caused by extreme weather events, and are more susceptible to extreme heat days due to lack of access to air conditioning.<sup>14</sup>
- **Weathering** – The cumulative impact of discrimination, racial violence, and social and political marginalization by African Americans over time has demonstrated lasting health impacts over time, materializing in earlier health deterioration in comparison to comparable White communities. The stress experienced by an African American living through daily discrimination can lead to chronic stress, and morbidity and mortality outcomes typical of an older White individual.<sup>15</sup>

## Key Climate Change and Health Issues for African American Communities

African Americans are disproportionately impacted by climate change due to factors including geographic distribution and socioeconomic inequities leading to inequities in living and working conditions, neighborhood characteristics, and health care access.

### African Americans: Less Responsible for Climate Change, More Supportive of Climate Action.

“African Americans are thirteen percent of the U.S. population and on average emit nearly twenty percent less greenhouse gases than non-Hispanic Whites per capita. Though less responsible for climate change, African Americans are significantly more vulnerable to its effects than non-Hispanic Whites.”

The Climate Gap”<sup>16</sup>

- 60% of African Americans ranked global warming among the most serious issues in the U.S. in 2015.
- 67% of African Americans say that action should be taken to counteract climate change.
- 83% supported the Clean Power Plan.<sup>17</sup>

### Extreme Heat

See Section [4.1—Extreme Heat](#)

Heat-related deaths in African Americans occur at a rate 150 to 200% greater than that for non-Hispanic Whites.<sup>18</sup>

### Extreme Heat and Climate Change

- Extreme heat results in excess death and illness through heat stroke, heat exhaustion, and exacerbations of chronic illness.<sup>19</sup>
- Heat increases ozone levels, exacerbating asthma, other respiratory disease and cardiovascular disease.<sup>20</sup>
- Due to climate change, extreme heat events are increasing in frequency, severity, and duration.<sup>21</sup>

### Why African American Communities are at Risk

- **Neighborhood** – 43% of African Americans live in “urban heat islands,” compared to 20% of Whites, and are therefore more likely to experience negative health outcomes associated with extreme heat.<sup>22</sup> The urban heat island effect occurs when heat is retained in an area due to heat-retaining asphalt and concrete and lack of cool green space and trees. Lack of tree canopy coverage also decreases access to shady areas in hot weather.<sup>23</sup>
- **Housing Quality** – Because a higher proportion of African Americans are low-income, they have less access to heat-adaptive housing features such as insulation or air conditioning in their homes, further exposing them to extreme heat events.<sup>24</sup>
- **Pre-Existing Conditions** – 46% of African Americans adults over 19 are diagnosed with cardiovascular disease.<sup>25</sup> Compared with non-Hispanic Whites African Americans have “1.3-times greater rate of non-fatal stroke, a 1.8-times greater rate of fatal stroke, a 1.5-times greater rate of death attributable to heart disease, and a 4.2-times greater rate of end stage kidney disease.”<sup>26</sup> These disorders can all be exacerbated by extreme heat.<sup>27</sup>

## Air Quality

See Section [4.4—Air Quality](#)

### Air Quality, Climate Change, and Health

- Climate change makes it more difficult to attain national air quality standards for ground-level ozone, a major component of smog, and is expected to cause increased exposure to particulate matter pollution in urban settings.<sup>28</sup>
- Common sources of greenhouse gas emissions (i.e. from motor vehicles and energy production) also produce many different air toxics, which are harmful to health.<sup>29</sup>
- Individuals with pre-existing chronic conditions, such as asthma, other respiratory disease, and cardiovascular disease, are at greater risk of disease exacerbations and complications due to air pollution.<sup>30</sup>

### Why African American Communities Are at Risk

- **Neighborhood** – 71 % percent of African Americans live in counties in violation of federal air pollution standards, compared to 58 % of non-Hispanic Whites.<sup>31</sup>
- **Pre-Existing Conditions** – African Americans have a 36 % higher rate of asthma incidents than non-Hispanic Whites, and an African American is 3x more likely to die or visit the emergency room from asthma-related complication in comparison to a non-Hispanic White individual.<sup>32</sup> Poor air quality exacerbates asthma.<sup>33</sup>

## Extreme Weather Events

See Section [4.7—Storms and Flooding](#)

### Extreme Weather Events, Climate Change, and Health

- Climate change is expected to increase the strength and resulting destruction of storms due to increased water temperatures leading to more precipitation, flooding, greater storm surges, and strong storm systems and winds.<sup>34</sup>
- Extreme weather causes interruptions in medical care and disrupts critical infrastructure including electricity, sanitation and water treatment, food refrigeration, health care, communications systems and transportation.<sup>35,36</sup>
- Extreme storms can also impact indoor air quality through flooding damage and mold, spread of infectious and vector-borne disease, toxic exposures, and mental health outcomes and can lead to displacement.<sup>37,38,39</sup>

### Why African American Communities Are at Risk

- **Geography** – The six states with the highest African American population—Mississippi, Louisiana, Georgia, Maryland, South Carolina, and Alabama—are also projected to be impacted by more Atlantic hurricanes and extreme storms.<sup>40</sup>
- **Homeownership and Insurance** – The homeownership rate for African Americans in 2015 was 33 %, lower than the rate in 1960 and half the level for comparable non-Hispanic Whites.<sup>41</sup> Renter status leaves families vulnerable following storm damage. Racial discrimination is also still extensively seen in homeowner insurance markets, leaving more African American families with less protection following extreme storms and related damage.<sup>42</sup>

- **Poverty** – One out of five of African American families are in poverty, compared to one out of fifteen White families. During an extreme weather event, these households have a smaller cushion against property damage or injuries, further complicated by lack of access to medical care and insurance.<sup>43</sup>
- **Pre-Existing Conditions** – African Americans have higher rates of chronic illnesses such as cardiovascular and respiratory disease. African Americans also had the highest incidence and death rates from cancer in 2012, and individuals from this community face higher levels of mental health and trauma outcomes.<sup>44</sup> Extreme storms can disrupt access to care and services for these illnesses, leaving African American communities vulnerable.

### Climate Resilience and Social Cohesion

During the Chicago heat wave of 1995, low-income communities of color generally fared the worst outcomes. In fact, overall, excess mortality rates from this event were fifty percent higher for non-Hispanic African Americans than for non-Hispanic Whites.<sup>45</sup> However, there was an exception to this. Some low-income African American communities were among the least impacted in terms of heat-related deaths, an effect thought to be related to high levels of community interaction and organization. Communities with high levels of social cohesion decrease isolation among residents, improve health and quality of life, and ultimately increase resilience against extreme events.<sup>46</sup>

Steps can be taken to foster resiliency throughout an extreme weather event, such as mapping vulnerable communities in advance and working with these communities to understand what strengths are present to plan and prepare for destructive weather.

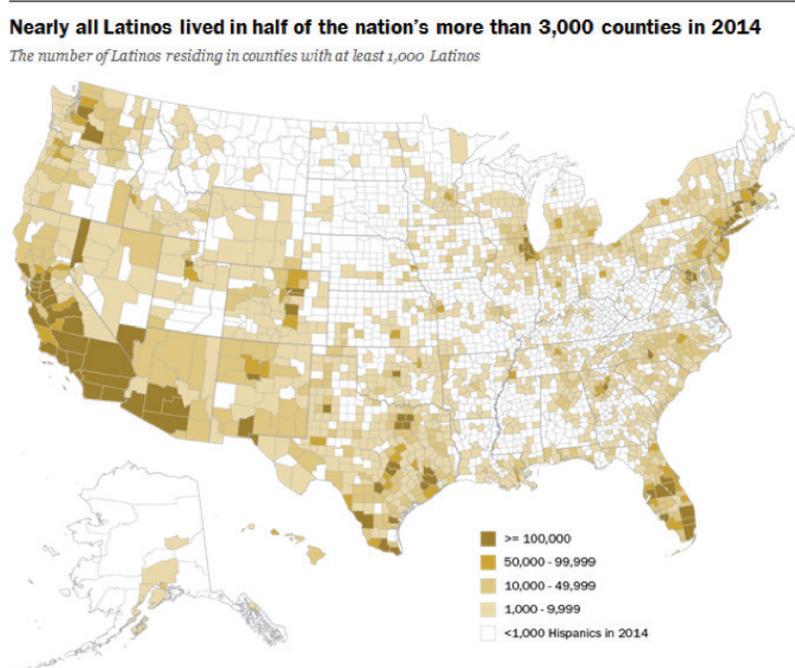
### A3.2: Latinos, Hispanics and Latinx and Climate Change, and Health

#### Latinos, Hispanics and Latinx, in the United States

“Latino” is an umbrella term used to identify a diverse collective of peoples from different countries, cultures, and backgrounds (Table A3.2.1). An estimated 56 million Latinos live in the United States, the majority of whom are second or third generation U.S. citizens.<sup>47</sup> This number expected to double to 119 million by 2060, being driven primarily by native births rather than immigration.<sup>48,49</sup> Latino communities represent a rising share of the United States population, and Latino communities are dispersing further, beyond California, Florida, and Texas, and into more regions of the South and the Midwest (Figure A3.2.1).<sup>50</sup>

Table A3.2.1		LATINO IMMIGRANTS COUNTRIES OF ORIGIN (2015) <sup>51</sup>
Mexico		67.9%
Puerto Rico		10.1%
El Salvador		4.0%
Dominican Republic		3.4%
Guatemala		2.6%
Cuba		3.9%
Other		8.0%

**Figure A3.2.1:** Number of Latinos residing in U.S. counties



## Social Determinants of Health and Health Equity

Present-day Latino communities have lower income, less education, and poorer health status than non-Hispanic White communities overall, largely due to historical discriminatory practices in housing, education, employment, and healthcare.

### Historical Influences

- **Immigration** – In 2015, 41.4% of foreign-born residents of the U.S. came from Central and Southern American countries.<sup>52</sup> There are physical and mental health challenges related to immigrating, and these can be further exacerbated by related policies and discrimination in the destination country.<sup>53</sup> This is especially true for undocumented immigrants who face higher stress levels regarding their immigration status and safety.<sup>54</sup>
- **“Healthy Immigrant”** – Voluntary immigrants to the U.S. from non-western countries often demonstrate better than expected health and mortality outcomes—perhaps stemming from the difficulties of migration, barring less healthy individuals from being able to. This “paradox” can be used to overlook social inequities.<sup>55</sup>
- **Acculturation** – While evidence suggests that newly arrived immigrants are often healthier than comparable native-born persons, evidence also supports that immigrant health declines with time in the U.S.<sup>56</sup> This decline in health has been associated with changes in diet, work-related stressors, and stresses related to the immigration process and discrimination.<sup>57</sup>

### Key Social Determinants

Such historical policies have led to present-day social inequities in Latinos. Additional social determinants will be discussed in relation to specific climate impacts discussed below.

- **Health care** – In 2014, 26.5% of individuals below the age of 65 who identified as Latino lacked health insurance, when compared to 10.4% of those in the same age group who identified as Non-Hispanic White.<sup>58</sup> The gap was higher for individuals over the age of 65 and those earning below the federal poverty line.<sup>59</sup>
- **Poverty** – In 2015, despite a 6.1% increase in household income for Latino families from 2014, the average household income for Latinos was close to 30% lower than that of Non-Hispanic Whites.<sup>60</sup> Close to one out of five of Latino families are in poverty, compared to one out of twelve Non-Hispanic White families.<sup>61</sup> These households have a smaller cushion against property damage or injuries caused by extreme weather events, and are more susceptible to extreme heat days due to lack of access to air conditioning.

### Key Health Inequities

- **Obesity** – 42.5% of adults who identified as Hispanic in 2014 were classified as obese, growing from 20% in 1990.<sup>62</sup> The prevalence of obesity within Latino communities varies wildly based on gender and country and culture of origin. Disparities also exist between U.S.-born and foreign-born Latinos, as 47.1% of U.S.-born Latinos are obese, compared to 36.3% of foreign-born individuals.<sup>63</sup> Obesity increases the risk of different health issues, including CVD and stroke.<sup>64</sup>

### Key Climate Change and Health Issues for Latino Communities

More than 60% of Latino communities live in areas that are most impacted by extreme heat, air quality issues, and flooding, largely as a result of inequities in housing, occupation, socioeconomic status, and structural and historical factors.<sup>65</sup> At the same time, their carbon footprint is smaller—they drive and fly less, use public transit,

live in smaller homes, and purchase fewer items that have travelled thousands of miles.<sup>66</sup> Despite this quandary, Latinos do and will experience thousands of additional illnesses and deaths per year in the decades ahead due to climate change impacts.

## Air Quality

See Section [4.4—Air Quality](#)

### Air Quality, Climate Change, and Health

- Climate change makes it ever more difficult to attain national air quality standards for ground-level ozone, a major component of smog, and is expected to cause increased exposure to particulate matter pollution in urban settings.<sup>67</sup>
- Common sources of greenhouse gas emissions (i.e. from motor vehicles and energy production) also produce many different air toxics, which are harmful to health.<sup>68</sup>
- Individuals with pre-existing chronic conditions, such as asthma, other respiratory disease, and cardiovascular disease, are at greater risk of disease exacerbations and complications due to air pollution.<sup>69</sup>

### Why Latino Communities Are at Risk

- **Neighborhood** – Nearly 1 in 2 Latinos live in counties frequently violating clean air and ozone standards, exacerbating air quality issues, and across the U.S., over 1.8 million Latinos live within a half-mile radius of oil and gas development.<sup>70,71</sup>
  - In 2010, 28.3% of Latino individuals in the U.S. lived near a major highway, which is associated with higher rates of respiratory and cardiac health outcomes, higher cancer risk, and poorer pregnancy outcomes.<sup>72</sup>
- **Pre-Existing Conditions** – Latino children as a whole are twice as likely to die from asthma as non-Latino Whites.<sup>73</sup> Puerto Rican children, in the highest incidence of any ethnic group, are almost three times as likely to have asthma; compared to non-Hispanic Whites.
  - Latino children who live in areas with higher levels of air pollution have a heightened risk of developing Type 2 diabetes than Latino children living outside of these neighborhoods.<sup>74</sup>

## Extreme Heat

See Section [4.1—Extreme Heat](#)

### Extreme Heat, Climate Change, and Health

- Extreme heat results in excess death and illness through heat stroke, heat exhaustion, and exacerbations of chronic illness.<sup>75</sup>
- Heat increases ozone levels, exacerbating asthma, other respiratory disease and cardiovascular disease.<sup>76</sup>
- Due to climate change, extreme heat events are increasing in frequency, severity, and duration.<sup>77</sup>

### Why Latino Communities Are at Risk

- Latinos are 21% more likely than non-Hispanic Whites to live in urban heat islands, or immediate geographic areas dominated by heat-retaining asphalt and concrete where cool, shade-producing green space and trees are lacking.<sup>78</sup>
- More than 4.3 million Hispanics households lack air conditioning.<sup>79</sup>

## Sea Level Rise and Flooding

See Section [4.6—Sea Level Rise](#)

### Sea Level Rise, Flooding, Climate Change, and Health

- Climate change is causing sea level rise around the world, as a result of melting glaciers and thermal expansion due to rising ocean temperatures.<sup>87</sup>

## Latino Workers and Extreme Heat

Latinos are more likely to work in outdoor occupations that expose workers to environmental health and climate change risks, including farming, construction, and transportation.<sup>80</sup> The majority of occupational heat-related deaths occur in these industries, and **Latinos have three times the risk of heat-related death on the job** than do non-Hispanics.<sup>81</sup> The relative risk of heat-related death was 3.4 among Latino agricultural workers and 1.7 among Latino construction workers when compared to non-Hispanic Whites.<sup>82</sup>

Across the U.S., Latinos make up nearly half of all farmworkers and their representation in California is 92%.<sup>83</sup> From 2003–2006, 71% of heat-related crop worker deaths in the U.S. occurred within the Mexican, Central or South American farmworker communities.<sup>84</sup> Results from an Oregon survey of farmworkers—97% of whom were foreign-born, primarily from Mexico—64% of respondents reported experiencing a symptom of heat-related illness during a hot day at work in the past week (i.e. heavy sweating, headache, etc.). 15.6% of participants reported being “very concerned” about the health effects of working in hot conditions but less likely to be “very comfortable” taking a break, which could lead to more heat-related illness.<sup>85</sup> There are approximately 120,000 children farm laborers across the country, making them an often-hidden subpopulation at risk for heat illness.<sup>86</sup>

- Flooding and storm surges associated with sea level rise increase risks for drowning, injury and displacement, which can lead to additional mental health outcomes and trauma, developmental impacts on children, and difficulties with chronic disease management.<sup>88,89,90,91</sup>
- Areas with waste facilities, landfills, smelters, ship yards, and military bases along the coast, rising sea level could also lead to the spread of toxic sediments and contamination of ground and surface waters.<sup>92</sup>

### Why Latino Communities Are at Risk

- **Neighborhood** – Property values are a key factor in determining protections for sea-level rise and flood barriers. Latinos in hurricane-prone areas have median home values lower than those of non-Hispanic Whites. As a result, Latino neighborhoods do not receive the same protective infrastructure as wealthier neighborhoods.
  - Latino communities make up 40% of the population in the areas of Florida that are very likely—regardless of any climate action—to experience high tide flooding from sea level rise.
- **Disaster Aid** – Undocumented Latino individuals are ineligible for federal disaster aid to help cope with extreme weather events and may not seek assistance or services following an extreme flooding event due to fears of deportation.<sup>93,94</sup>

- **Housing Quality** – Latino populations living in substandard housing are at greater risk of flood-related exposures, like mold, worsening health conditions like asthma.<sup>95</sup>

## Food Systems

See Section [4.8—Food Security](#)

### Food Security, Agriculture, and Climate Change

- Crop yields are reduced by extreme heat, drought, and extreme weather events, all of which are increasing in frequency and severity due to climate change.<sup>96</sup>
- Increased atmospheric carbon dioxide results in a reduction in the levels of protein and micronutrients (e.g. calcium, zinc, iron) in important crops like barley, sorghum and soy.<sup>97</sup>
- Extreme weather events can prevent transportation of food products, disrupting food supply chains, increasing prices, and increasing loss due to spoilage.<sup>98</sup>
- As climate change increases, pressure will build for greater crop yields, and pesticide use is expected to increase with this building pressure.<sup>99</sup>

### Why Latino Communities Are at Risk

- **Occupation** – In California, 92% of farmworkers are Latino and 73% of all farmworkers earn less than 200% of the Federal Poverty Level.<sup>100</sup>
- **Food Security** – 21% of Latinos are food insecure, compared to 10% of non-Hispanic Whites and 13% of Americans overall.<sup>101</sup>
  - In 2012, Latino households spent an average of 15.5% of their income on food, compared to 12.6% that non-Hispanic Whites spent from their incomes.<sup>102</sup>
- **Pesticide Exposure** – Latinos account for 70% of the population in the ten zip codes with the highest pesticide use in California.<sup>103</sup>

### Climate Action

Despite bearing less of the responsibility and more of the impact for climate change, Latinos are leading the nation on this issue. Not only do Latino communities overwhelmingly support action on climate change policies, in many cases, these communities take the lead within environmental justice movement.<sup>104</sup>

- In the 2016 Presidential election, concern for environmental issues tripled among Latino voters compared to 2012. More than three-quarters (77%) of voters, including half of those who voted for President Trump, support the U.S. moving to 100% renewable energy by 2050.<sup>105</sup>
- 82% of Latinos in the U.S. feel the U.S. should move away from fossil fuels and invest in renewable energy.<sup>106</sup>
- 90% of Latinos in the U.S want climate action and reject the notion that climate action will hurt the economy or cost jobs. In fact, many believe that progressive environmental policies will be good for the country's economic state. In their own lives, many are willing to pay \$5 to \$10 more per month for renewable energy.<sup>107</sup>

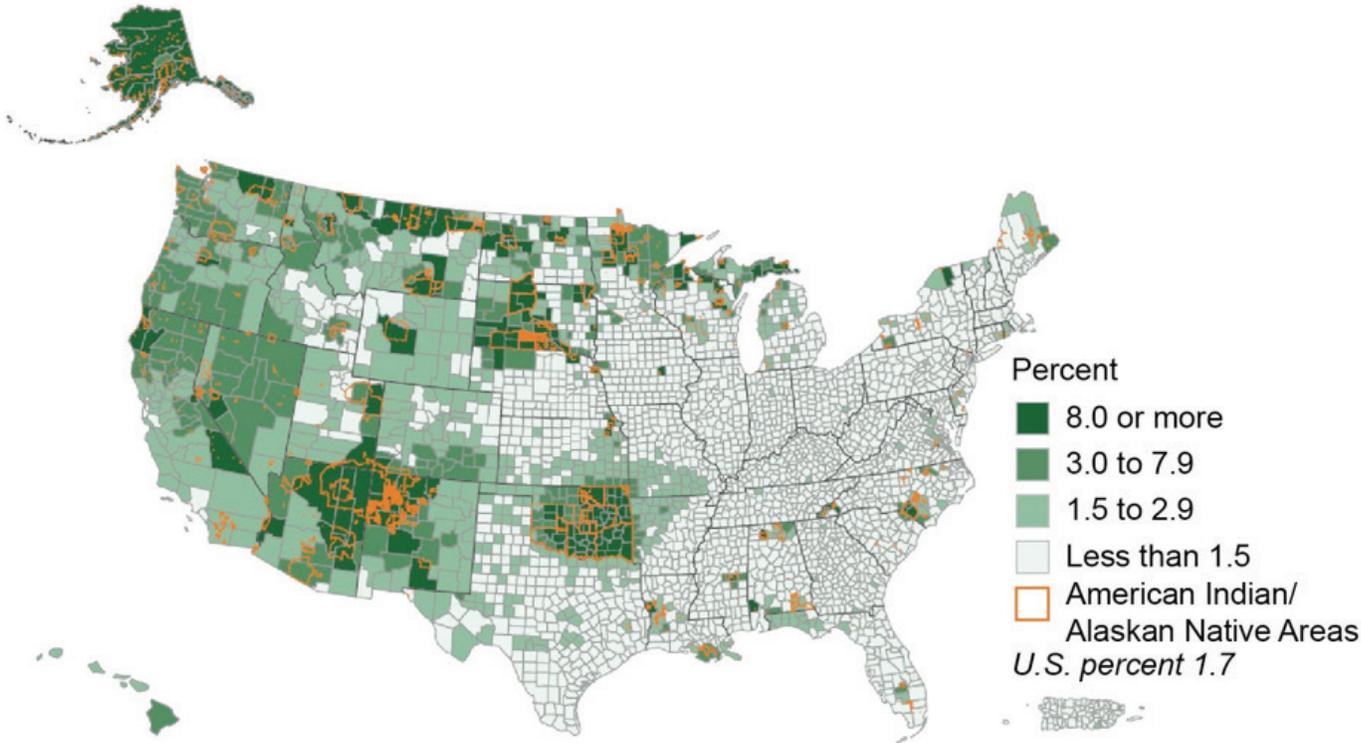
### A3.3: Native Americans and Alaska Natives, Climate Change, and Health

#### Native Americans and Alaska Natives in the United States

There are approximately 5.2 million Native Americans and Alaska Natives in the U.S., a population divided between 566 federally recognized tribes. 1.1 million NA/ANs live on or near reservations, mostly in the Northwest, Southwest, Great Plains, and Alaska.<sup>108</sup> Despite historical decimation of tribes during the Colonial period in the U.S., in the past 10 years, the NA/AN population has increased by 27% since 2000, triple the rate of the total U.S. population.<sup>109</sup> Alaska, Oklahoma, and New Mexico have the highest proportion of Native Americans and Alaska Natives in their populations, and California, Oklahoma, and Arizona have the largest number of Native individuals living within their borders (Figure A3.3.1).<sup>110</sup>

Figure A3.3.1: Indigenous populations of Native Americans and Alaska Natives

### Indigenous Populations Extend Beyond Reservation Lands



## Social Determinants of Health and Health Equity

### Historical Influences

- **Colonization, Genocide, and Disease:** Throughout the colonization of the United States by Europeans and U.S. history, Native communities have been the targets of violence, bioterrorism, and forced relocation. While it is believed that there were more than 5 million Native peoples in the U.S. before European settlement, there were only 200,000 by 1900.<sup>111</sup>
- **The Indian Removal Act of 1830:** This act sought to displace NA/ANs from their tribal lands to resource-deficient, isolated and infertile land to allow for European settlement across the country. This process resulted in numerous wars against resisting tribes, as well as the “Trail of Tears”—a forced relocation journey in which 3000–4000 Cherokee Nation members perished. Throughout U.S. history, tribes have been actively split into disparate communities and dispossessed of their land, culture, and resources, leaving them vulnerable to physical and mental health challenges.<sup>112</sup>
- **Residential Schools for Native American Children** – In the late 19th and early 20th centuries, boarding schools were opened to assimilate Native Americans children to Western, European culture, which served the purpose of systemically erasing native culture, language, and traditions. Children were punished for speaking their native languages, and sometimes mocked by teachers for traditional practices—effectively making the children see their culture as inferior.<sup>113</sup>

### Key Social Determinants

Such historical policies have led to present-day social and health inequities in Native American and Alaskan Native communities. These policies led to a shift from traditional lifestyles, and left long-term secondary impacts of persistent poverty, food and resource insecurity, homelessness, inadequate education, substandard health services, lack of access to electricity and running water, and a lack of modern communication methods— many reservations have no cell phone reception, and less than 10% of residents have internet access.<sup>114</sup> A comparison of some social and economic disparities is seen in Table A3.3.1.

Table A3.3.1		SOCIAL AND ECONOMIC DISPARITIES BETWEEN NATIVE AMERICANS AND ALASKAN NATIVES AND THE GENERAL U.S. POPULATION (2015)	
Indicator (2015)	Single-race NA/ANs <sup>115</sup>	General U.S. Population <sup>116</sup>	
Have less than high school diploma	20.9%	12.9%	
Unemployment	12%	6.3%	
Median household income	\$41,940	\$55,775	
Private	44.8%	67.5%	
Poverty	26.6%	13.5%	

Table continued on next page

Health insurance		
None	20.7%	9.4%
Public	42.8%	34.7%
Private	44.8%	67.5%
Poverty	26.6%	13.5%

### Health Inequities

- **Trauma** –The trauma faced from the loss of people, land, and culture has been passed on to subsequent generations via conversation, practices, and attitudes towards these events.<sup>117</sup> The high rates of alcohol abuse in Native American and Alaskan Native communities is thought to be partially attributed to the low self-esteem, loss of cultural identity, and lack of positive role models that stem from this historical trauma.<sup>118</sup>
- **Chronic Illness** – Death rates from chronic liver disease and cirrhosis, diabetes mellitus, unintentional injuries, and chronic lower respiratory disease are significantly higher for NA/ANs than the general U.S. population. NA/ANs’ rate of death from diabetes is three times that of the general U.S. population.<sup>119</sup>
- **Behavioral Health** – High levels of alcohol and substance abuse, mental health disorders, suicide, violence, and behavior-related chronic diseases contribute to the lower life expectancy in comparison to the general U.S. population.<sup>120</sup>

### Key Climate Change and Health Issues for Native American and Alaskan Native Communities

As a result of discriminatory policies related to historical U.S. settlement NA/ANs often live in geographically isolated areas. They depend heavily on the environment to maintain cultural practices and ways of living and are thus stewards of the environment. Tribal communities’ food security, water quality, and land are at risk due to climate change-related weather events, and these in turn have widespread health consequences.

### Food Security

See Section [4.8—Food Security](#)

#### Food Security, Agriculture, and Climate Change

- Crop yields are reduced by extreme heat, drought, and extreme weather events, all of which are increasing in frequency and severity due to climate change.<sup>121</sup>
- Increased atmospheric carbon dioxide results in a reduction in the levels of protein and micronutrients (e.g. calcium, zinc, iron) in important crops like barley, sorghum and soy.<sup>122</sup>
- Extreme weather events can prevent transportation of food products, disrupting food supply chains, increasing prices, and increasing loss due to spoilage.<sup>123</sup>
- Warmer temperatures increase the growth of *Salmonella*, *Camphylobacter*, *Rotavirus*, and various *Vibrio*, and harmful algal blooms, increasing the risk of food contamination.<sup>124</sup>

### Why Native American and Alaskan Native Communities Are at Risk

- Local Food Resources
  - NA/ANs often rely on traditional foods and subsistence living fishing and farming, impacted significantly by drought, heat, extreme precipitation, and ocean acidification.
  - Arctic communities are already facing issues such as decreased thickness of sea ice, coastal erosion, and altered geographic ranges of some fish. The disruption to hunting and subsistence practices could force relocation.<sup>125</sup>
  - In 40 to 80 years, a loss of more than half of the salmon and trout habitats is predicted throughout the United States due to increased ocean acidity caused by higher atmospheric CO<sub>2</sub> levels.<sup>126</sup>
- **Toxins** – Higher temperatures affect ocean water quality and can lead to increased mercury levels in fish. Mercury is a known neurotoxin disproportionality affecting pregnant women and children.<sup>127</sup>
- **Nutrition** – Loss of traditional foods leads to food shortages, increased food prices in isolated communities (up to 15 dollars for a gallon of milk) and contributes to a lack of proper nutrition.<sup>128</sup> Diagnosed diabetes rates from 6.0% among Alaska Natives to 24.1% among American Indians in southern Arizona.<sup>129</sup>

### Infectious Disease

See Section [6.6—Clinical Services](#)

#### Infectious Disease, Climate Change, and Health

- The frequency and intensity of extreme precipitation and flooding is increasing with climate change, and more than 50% of water-borne disease outbreaks in the U.S. are associated with extreme rainfall.<sup>130,131</sup>
- Warmer water temperatures, in both ocean and freshwater sources, allow for greater proliferation of microorganisms such as *Vibrio* that cause gastrointestinal and more serious illness, including cholera.<sup>132</sup>

### Why Native American and Alaskan Native Communities Are at Risk

- **Water Access** – Native American and Alaskan Native communities who reside in remote areas lack access to clean, potable drinking water at higher rates than other groups in the U.S.<sup>133</sup>
- **Local Food Resources** – Greater reliance on subsistence fishing and harvesting of coastal mollusks may put communities at greater risk of exposure to microorganisms that cause illness.
- **Existing Burden** – The rate of diarrhea-associated hospitalizations for Native American and Alaskan Native children from 2000–2004 was nearly twice the rate among all U.S. infants, and the rate of diarrhea-associated outpatient visits among Native children was higher than for all U.S. children.<sup>134</sup>

## Extreme Weather Events

See Section [4.7—Storms and Flooding](#)

### Extreme Weather Events, Climate Change, and Health

- Climate change is expected to increase the strength and resulting destruction of storms due to increased water temperatures leading to more precipitation, flooding, greater storm surges, and strong storm systems and winds.<sup>135</sup>
- Extreme weather causes interruptions in medical care and disrupts critical infrastructure including electricity, sanitation and water treatment, food refrigeration, health care, communications systems and transportation.<sup>136,137</sup>
- Extreme storms can also impact indoor air quality through flooding damage and mold, spread of infectious and vector-borne disease, toxic exposures, and mental health outcomes and can lead to displacement.<sup>138,139</sup>

### Why Native American and Alaskan Native Communities Are at Risk

- **Water Access** – 20% of rural Alaskan homes lack access to piped water and a flush toilet, which can leave these populations without access to potable water and clean water to use for washing.<sup>140</sup>
- **Infrastructure** – Researchers have estimated that climate change could add \$3.6–6.1 billion to future costs for Alaskan infrastructure repairs by 2030. Renter status leaves families vulnerable following storm damage.<sup>141</sup>
- **Poverty** – In these coastal regions and similarly vulnerable tribal lands, the costs associated with increased damage due to climate change are expected to far outweigh any local government or organization’s ability to pay for them, and the high rates of poverty in these communities will make it difficult for tribes to support themselves.<sup>142</sup>
- **Pre-Existing Conditions** – Extreme storms can disrupt access to care and services for these illnesses, leaving Native communities, especially those located in remote areas with already limited resources, vulnerable.<sup>143</sup>

## Drought and Wildfires

See Section [4.2—Drought](#)

### Drought, Wildfires, Climate Change, and Health

- Rising temperatures will cause significant challenges to forest communities in the Southwest.<sup>144</sup>
- An increased risk of forest fire as well as a loss of culturally significant native plants and animal species has already been observed.<sup>145</sup>
- Due to climate change, megadroughts are expected Southwest and Central Plains, impacting drinking water availability.<sup>146</sup>

## Why Native American and Alaskan Native Communities Are at Risk

“Fire affects the plants, which affect the water, which affects the fish, which affect terrestrial plants and animals, all of which the Karuk rely on for cultural perpetuity.”<sup>147</sup>

- **Geography** – Native American and Alaska Native populations living in and near forested regions are at increased risk of displacement, smoke-exposure, injury, and property loss from wildfires, especially if more populated areas are prioritized for fire management response.<sup>148</sup>
- **Food Security** – Native American and Alaskan native populations face high food prices for healthy foods, and a lack of proper nutrition: one in four Native American children ages 2 to 5 years old is obese, and a third of those ages 6–19.<sup>149</sup>

## Traditional Ecological Knowledge

NA/AN communities view the natural environment as a living entity to be honored and respected. This relationship has fostered the development of traditional ecological knowledge, or TEK, “an accumulating body of knowledge, practice, and belief...about the relationship of living beings (human and non-human) with one another and with the environment.”<sup>150</sup> It is developed through centuries of direct contact and careful observations of animal and plant species, natural processes, and landscapes, and is passed down from generation to generation.

TEK is an essential component of adaptation efforts in NA/AN communities and can be leveraged to develop strategies specific to a geographical region. While many traditional practices are becoming more difficult to maintain, some communities have merged TEK with western-based approaches for increased resiliency. The Pyramid Lake Paiute Tribe, Nevada’s largest tribe, worked with scientists to develop key ecological indicators such as snow pack level, lake water temperature, and bird and fish counts to keep record of variations potentially linked to climate change.<sup>151</sup> These records can be used in developing effective natural resource management.

In an effort to decrease disaster risk, the Navajo Reservation has also employed a joint approach with climate researchers and Navajo elders working together to record meteorological and hydrological changes.<sup>152</sup> Thus, merging traditional practices and knowledge with modern advancements may be the key to developing effective adaptation strategies.

### A3.4: Asian Americans, Climate Change, and Health

Asian Americans are the fastest growing racial group in the United States.<sup>153</sup> However, Asian Americans still represents a small proportion of the total U.S. population, so it is difficult to achieve a fully representative study of this diverse group. Little information is available on the potential for disproportionate health impacts from social or climate factors within these populations.<sup>154</sup>

This brief highlights how social determinants of health and climate change could interact to exacerbate existing health outcomes in Asian Americans communities, and how climate solutions offer opportunities for health.

#### Asian Americans in the United States

While Asian Americans are the fastest growing racial group in the U.S., in total, this group, which comprises individuals from many different countries, makes up a small percentage of the total U.S. population. In 2011, over 18 million individuals in the U.S. identified as Asian American, making up 5.8% of the total population. 83% of these individuals identified as Chinese, Filipino, Indian, Vietnamese, Korean, and Japanese American (Table A3.4.1).<sup>155</sup>

#### Social Determinants of Health and Health Equity

Asian Americans live with a history of discrimination and present-day inequities that may continue to grow as Asian American communities expand in the U.S.

#### Historical Influences

- **Immigration Restrictions** – Until the Immigration Act of 1965, immigrants from Asian countries were restricted in the U.S. Because of these restrictions, a large proportion of the current U.S. Asian American population are first-generation (in 2011, 76% of Asian Americans were immigrants), which has in part lead to difficulties in sampling and representing these different groups in health.<sup>156</sup>
- **Japanese Internment** – Following the Japanese attack on Pearl Harbor in 1941, over 120,000 Japanese Americans of all ages, mostly from the Western states of California, Oregon, Washington, and Arizona, were forced to live separated from society in camps.<sup>157</sup> Studies have found lasting impacts of traumatic stress, especially for younger individuals, and an increase in cardiovascular disease in interned adults.<sup>158</sup>
- **20th Century Discrimination** – Due to U.S. conflicts in Korea and Vietnam and the rise of communism in China in the 1940s, immigrants from these countries faced discrimination based on what was portrayed as “dangerous” connections they had to U.S. enemies.<sup>159</sup> The lasting impacts from this discrimination, and its continual impacts in the present, have led to poorer mental health outcomes and increased risk of cardiovascular disease, diabetes, and other chronic health problems in various Asian American groups.<sup>160</sup>
- **“Model Minority”** – Originating in a 1966 New York Times article recounting the success of Japanese Americans in overcoming discrimination and assimilating to U.S. culture, this term has since been used to describe multiple Asian American groups, pointing out their higher educational attainments and financial security in comparison to the general U.S. population.<sup>161</sup> This label, while damaging to other minority groups who were painted as somehow less capable of achieving similar “successes,” also diverts attention away from real health and economic inequities that Asian Americans face and applies pressure for Asian Americans to conform to mainstream culture.

<b>Table A3.4.1</b>		<b>NUMBER OF ASIAN AMERICANS IN 2010</b>
<b>All Asian Americans in 2010 Census—17,320,856</b> Including those <18 years old		
Chinese (Including 215,441 Taiwanese)		4,010,114
Filipino		3,416,840
Indian		3,183,063
Vietnamese		1,737,433
Korean		1,706,822
Japanese		1,304,286
Pakistani		409,163
Cambodian		276,667
Hmong		260,073
Thai		237,583
Laotian		232,130
Bangladeshi		147,300
Burmese		100,200
Indonesian		95,270
Nepalese		59,490
Sri Lankan		45,381
Malaysian		26,179
Bhutanese		19,439
Mongolian		18,344
Okinawan		11,326

**Key Social Determinants**

- **Language** – Some Asian American populations have low English proficiency rates, which can lead to difficulties in accessing and receiving effective care.
  - In 2010, 53% of Vietnamese American, 46% of Korean American, 46% of Chinese American, 46% of Taiwanese American, 24% of Japanese American, 22% of Filipino American and 22% of Asian Indian reported limited English proficiency<sup>162</sup>
  - In 2014, 34% of Korean Americans, 29% of Vietnamese Americans, 19% of Asian Indians, and 18% of Filipino Americans, and 10% of Japanese Americans surveyed reported poor communication with their physician.<sup>163</sup>
- **Education** – Educational attainment varies widely throughout different Asian American groups, and educational access is a known determinant of health.
  - In 2007, one in three Vietnamese Americans and one in ten Korean Americans did not have a high school degree.<sup>164</sup>
- **Insurance** – Health care coverage varies widely among different Asian American populations.
  - 6% of Asian Americans are covered by employer-sponsored health insurance (compared to 26% of all Americans) (Table A3.4.2).<sup>165</sup>

Table A3.4.2		PERCENTAGE OF UNINSURED ASIAN AMERICANS
Population	Percent Uninsured (2010) <sup>166</sup>	
Korean Americans in Los Angeles	50%	
Chinese Americans in Oakland	35%	
Southeast Asians in San Diego	37%	
Vietnamese Americans in San Francisco	15%	
Asian Women in Southern California	21%	

### Key Health Inequities

Many Asian American ethnic groups are not represented in current research due to their limited numbers in the U.S., diversity within sub-groups, wide geographic dispersion, and language barriers—all which present difficulties in understanding potential health inequities and vulnerabilities within Asian American communities.<sup>167</sup> Studies often assess all Asian American populations as one conglomerate group, overlooking potential inequities between these groups based on country of origin.<sup>168</sup>

- Asian Americans are 4.5 times as likely to be infected with Hepatitis B and 10% more likely to be diagnosed with diabetes than Whites.<sup>169</sup>

### Key Climate Change and Health Issues for Asian American Communities

While no studies have assessed potential vulnerabilities in Asian American communities to climate change, there is emerging research on potential health impacts that burden Asian American populations in the U.S. These health outcomes are expected to worsen with climate change.

### Air Quality

See Section [4.4—Air Quality](#)

### Air Quality, Climate Change, and Health

- Climate change makes it ever more difficult to attain national air quality standards for ground-level ozone, a major component of smog, and is expected to cause increased exposure to particulate matter pollution in urban settings.<sup>171</sup>
- Common sources of greenhouse gas emissions (i.e. from motor vehicles and energy production) also produce many different air toxics, which are harmful to health.<sup>172</sup>
- Climate change may impact the residence time of air toxics in the air, while also their impacting dispersal and transport through the air.<sup>173</sup>
- Individuals with pre-existing chronic conditions, such as asthma, other respiratory disease, and cardiovascular disease, are at greater risk of disease exacerbations and complications due to air pollution.<sup>174</sup>

### Why Asian American Communities Are at Risk

- **Existing Burden** – Asian Americans eligible for Medicare have a higher estimated risk of death from PM2.5 exposure than the general population.<sup>175</sup>
  - Chinese American and Korean American populations were found to have the highest mean cancer risk from hazardous air pollutant exposure among all racial groups in the U.S., which could increase with climate change air impacts.<sup>176</sup>
    - Southeast and South Asian populations held the fourth and fifth highest cancer risk from hazardous air pollutants.<sup>177</sup>

## Asian American Environmentalists

Surveys from the California League of Conservation Voters found that 83% of Asian American Californian voters described themselves as environmentalists and 69% were extremely concerned about global warming.<sup>170</sup>

- Cancer is the leading cause of death across all Asian Americans groups in the United States, and two leading cancer types—lung and breast—are linked with hazardous air pollutants and other environmental exposures.<sup>178</sup>
- Climate change impacts on air quality are expected to exacerbate cardiovascular disease, which is the leading cause of death in Asian Indians, Filipino and Japanese American men and Asian Indian women, and climate change’s impacts on air pollution are expected to exacerbate the impacts of this chronic illness.<sup>179</sup>

**Extreme Heat**

See Section [4.1—Extreme Heat](#)

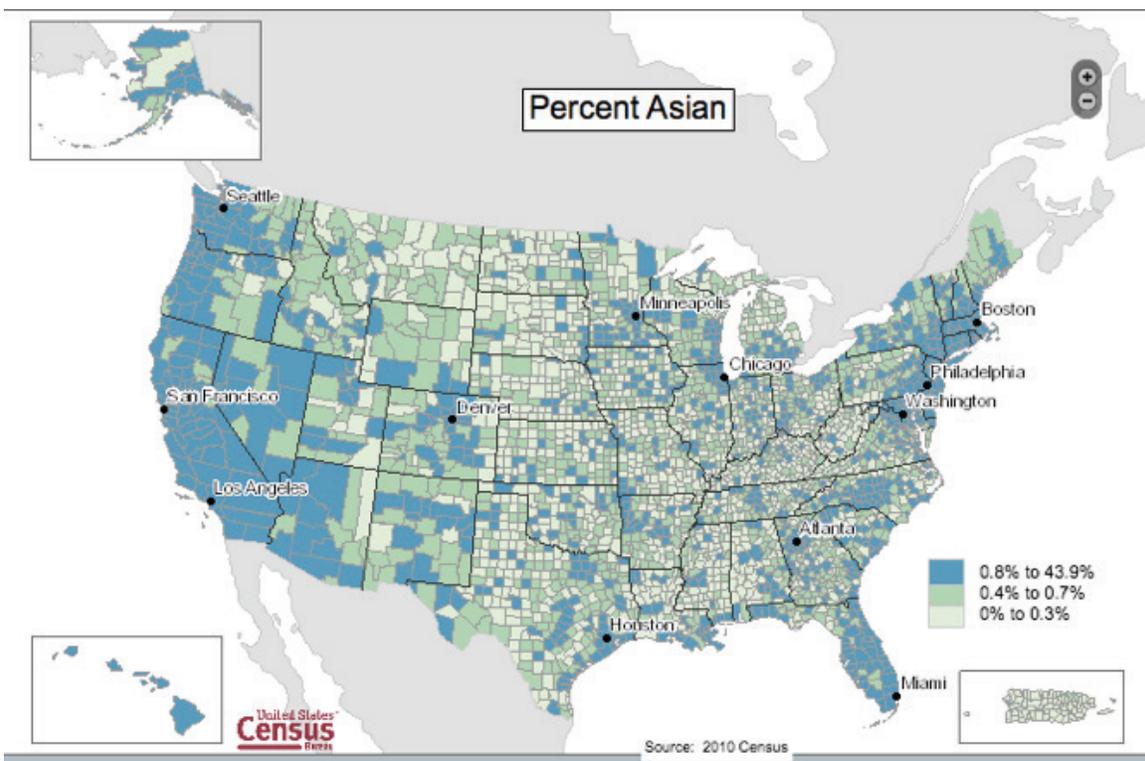
**Extreme Heat, Climate Change, and Health**

- Extreme heat results in excess death and illness through heat stroke, heat exhaustion, and exacerbations of chronic illness.<sup>180</sup>
- Heat increases ozone levels, exacerbating asthma, other respiratory disease and cardiovascular disease.<sup>181</sup>
- Due to climate change, extreme heat events are increasing in frequency, severity, and duration.<sup>182</sup>

**Why Asian American Communities Are at Risk**

- **Neighborhood** – Asian Americans are 32 % more likely than Whites to live in areas where heat-retaining hard surfaces cover more than half the ground, and more than half the population lacks access to cool shade-producing green space and tree canopy.<sup>183</sup>

**Figure A3.4.1:** Asian population by county in the U.S. according to the 2010 census.



## Sea Level Rise and Flooding

See Section [4.6—Sea Level Rise](#)

### Sea Level Rise, Climate Change, and Health

- Climate change is causing sea level rise around the world, as a result of melting glaciers and thermal expansion due to rising ocean temperatures.<sup>184</sup>
- Flooding and storm surges associated with sea level rise increase risks for drowning, injury and displacement, which can lead to additional mental health outcomes and trauma, developmental impacts on children, and difficulties with chronic disease management.<sup>185,186,187,188</sup>
- In areas with waste facilities, landfills, smelters, ship yards, and military bases along the coast, rising sea level could also lead to the spread of toxic sediments and contamination of ground and surface waters.<sup>189</sup>

### Why Asian American Communities Are at Risk

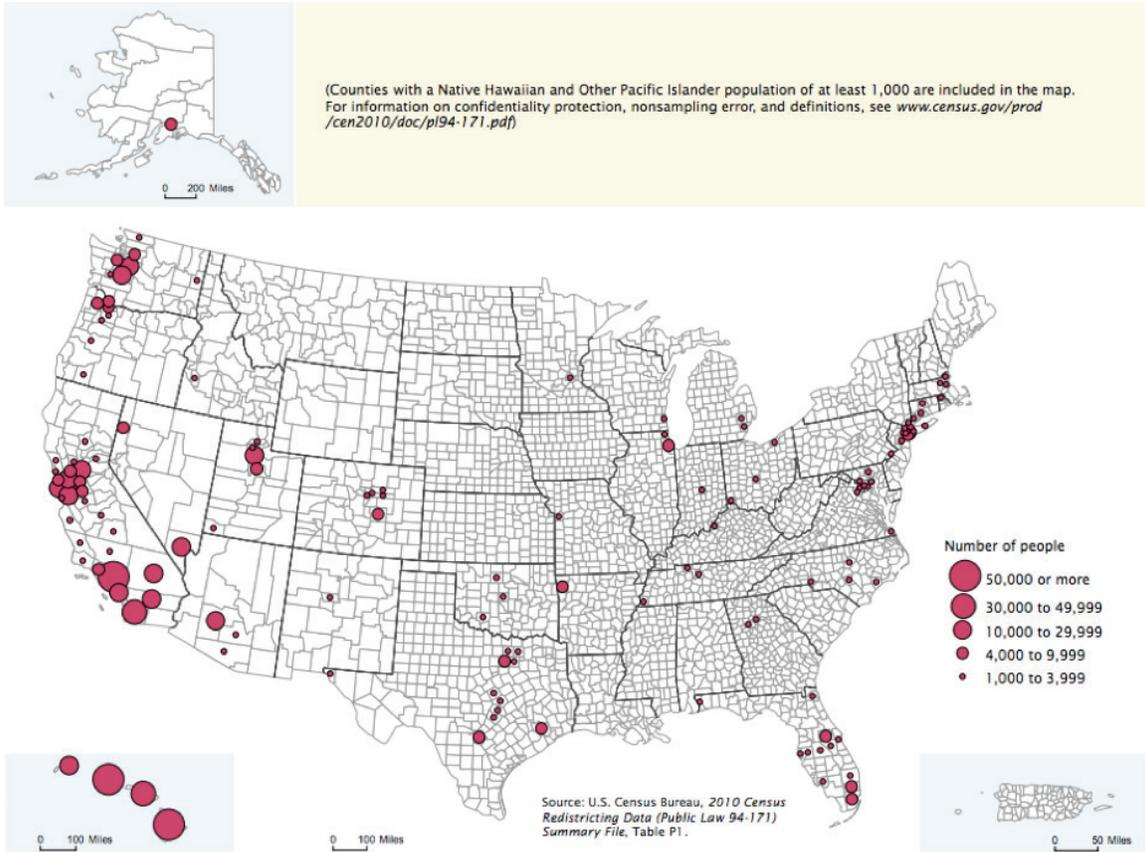
- **Geography** – Census data demonstrates that Asian American populations are highly concentrated in coastal regions, putting their communities, especially those that are low-income, at risk of displacement following rising sea levels.<sup>190</sup>

### A3.5: Native Hawaiians and Pacific Islanders, Climate Change, and Health

#### Native Hawaiians and Pacific Islanders in the United States

Native Hawaiians and Pacific Islanders in the U.S. refer to individuals who have origins in Hawaii, Guam, Samoa, or other Pacific Islands. According to the 2010 U.S. Census, there were over 1,225,000 Native Hawaiian and Pacific Islanders (NHPI) in the U.S., making up .4% of the population (Figure A3.5.1).<sup>191</sup> This census data also showed that 29% of this population reside in Hawaii and 23% reside in California, the only states with over 100,000 Native Hawaiian and Pacific Islanders, though Iowa, Missouri, South Dakota, North Dakota, Nebraska, Kansas, Ohio, and Vermont experienced a growth greater than 50 percent in their NHPI populations between 2000 and 2010.<sup>192</sup> 74% of these communities are made up of Native Hawaiians, Samoans, and Guamanians/Chamorros individuals, with the remaining 26% made up of Tongans, Fijians, Marshallese, and other Pacific Islanders.<sup>193</sup>

**Figure A3.5.1:** Native Hawaiian and other Pacific Islanders by county (2010 census).



## Social Determinants of Health and Health Equity

### Historical Influences

- **Colonization** – The U.S. formed relationships with Pacific Island nations to aid trade and military advances with Asian countries, causing economic shifts away from communal agricultural living to industrialization and urbanization. Cultural shifts also had vast mental and physical health impacts.<sup>194</sup>
- **Aggregated Data** – Historically, census and health data for Native Hawaiians and Pacific Islanders has been aggregated with Asian American data, distorting views of health within both groups. This is particularly dangerous for NHPI because aggregated data tends to overshadow real health needs in these communities and prevents informed and active responses.<sup>195</sup>
- **Military Testing** – U.S. military operations tested nuclear bombs on Pacific Islands, such as Micronesia, in the 1940s and 1950s, which exposed thousands of Pacific Islanders to related toxics and nuclear fallout.<sup>196</sup>

### Key Social Determinants

Such historical policies have led to present-day social and health inequities in Native Hawaiian and Pacific Islander communities (Table A3.5.1 and Table A3.5.2).

Table A3.5.1		INCOME, POVERTY STATUS, AND EDUCATION OF NATIVE HAWAIIANS AND PACIFIC ISLANDERS, 2011	
2011 Demographic and Socioeconomic Profiles <sup>197</sup>			
	Per Capita Annual Income	% of Families Below Poverty Line	% of Adults who Attained a Bachelor's Degree or Higher
General U.S. Population	\$27,100	9.9	27.8
Native Hawaiian/Pacific Islander	\$19,020	11.5	17.1
Fijian	\$21,456	5.3	12.4
Guamanian/Chamorro	\$20,054	9.6	18
Native Hawaiian	\$20,954	9.4	18
Samoan	\$15,567	13.6	12.6
Tongan	\$11,907	18.4	15
Other Pacific Islander	\$19,478	14.5	28.2

Table A3.5.2

2014 NATIVE HAWAIIAN AND PACIFIC ISLANDER NATIONAL HEALTH INTERVIEW SURVEY (NHIS)<sup>198</sup>

Indicator	General U.S. Population (%)	Native Hawaiian (%)	All Pacific Islander (%)
Obese BMI	29.3	37.9	47.8
Hypertension	24.5	27.4	29.8
Heart Disease	10.9	11.3	10.1
Adults with Asthma	7.4	13.3	5.8
Children with Asthma	8.6	16.7	5.2
Adults with Diabetes	8.5	14.2	17.7

**Health Inequities**

**Key Climate Change and Health Issues for Native Hawaiians and Pacific Islanders**

**Extreme Weather Events**

See Section [4.7—Storms and Flooding](#)

**Extreme Weather Events, Climate Change, and Health**

- Climate change is expected to increase the strength and resulting destruction of storms due to increased water temperatures leading to more precipitation, flooding, greater storm surges, and strong storm systems and winds.<sup>199</sup>
- Extreme weather causes interruptions in medical care and disrupts critical infrastructure including electricity, sanitation and water treatment, food refrigeration, health care, communications systems and transportation.<sup>200,201</sup>
- Extreme storms can also impact indoor air quality through flooding damage and mold, spread of infectious and vector-borne disease, toxic exposures, and mental health outcomes and can lead to displacement.<sup>202,203</sup>

**Why Native Hawaiian and Pacific Islander Communities Are at Risk**

- **Geography** – Models predict that by 2100, Hawai‘i and some Pacific islands will experience about 1ft–2.5ft higher sea-level rise when compared to global average.<sup>204</sup> More tropical cyclones developed in the Pacific between 1991 and 2010 than were recorded in the previous century.<sup>205</sup> Communities who remain on these islands are at risk of physical and mental health outcomes from such disasters, as well as other long-term impacts of structural damage. Families and communities living in the Continental U.S. will also be impacted through the stress of experiencing these tragedies through familial suffering. Those who move will suffer the economic, social, and emotional losses associated with forced migration.

- **Infrastructure** – Hawai‘i already closes beaches annually due to polluted runoff from storm water containing sewage or chemicals from industrial facilities.<sup>206</sup> This runoff is expected to increase, as storms grow stronger and more damaging.
- **Poverty** – Some Pacific Islander and Native Hawaiian communities lack socioeconomic resources to respond to the damage and health impacts resulting from extreme storms. During an extreme weather event, these households have a smaller cushion against property damage or injuries, further complicated by lack of access to medical care and insurance.<sup>207</sup>
- **Pre-Existing Conditions** – Extreme storms can disrupt access to care and services for chronic and infectious illnesses, leaving these communities vulnerable considering the high prevalence of illnesses such as diabetes and asthma.<sup>208</sup>
- **Existing Burden** – In 2001 and 2002, there was an outbreak of Dengue fever in Maui, during a period of warmer and wetter conditions, which are expected to increase with climate change.<sup>209</sup> Hawai‘i has historically had outbreaks of Leptospirosis, an infectious disease from waste-polluted surface waters, and research has demonstrated that infection rates increase during wetter periods.<sup>210</sup> Hawai‘i and other Pacific Islands are known tourist attractions, which could present additional risk of travelers bringing new disease vectors onto the island.
- **Neighborhood** – 84% of Native Hawaiian and Pacific Island neighborhoods in Los Angeles are located within one mile of a Superfund site, the highest of any racial group.<sup>211</sup> These communities are at additional risk following flooding due to the likelihood of runoff toxics and pollution from these sites into their neighborhoods and drinking water sources.

## Extreme Heat

See Section [4.1—Extreme Heat](#)

### Extreme Heat, Climate Change, and Health

- Extreme heat results in excess death and illness through heat stroke, heat exhaustion, and exacerbations of chronic illness.<sup>212</sup>
- Heat increases ozone levels, exacerbating asthma, other respiratory disease and cardiovascular disease.<sup>213</sup>
- Due to climate change, extreme heat events are increasing in frequency, severity, and duration.<sup>214</sup>

### Why Native Hawaiian and Pacific Islander Communities Are at Risk

- **Geography** – The average temperature in Honolulu has increased 4.4°F over the last century and research suggests it will continue to increase.<sup>215</sup>
- **Existing Burden** – The high prevalence of asthma, respiratory illness, and precursors to cardiovascular disease present additional vulnerabilities for these communities during extreme heat events.<sup>216</sup>

## Food Security

See Section [4.8—Food Security](#)

### Food Security, Agriculture, and Climate Change

- Crop yields are reduced by extreme heat, drought, and extreme weather events, all of which are increasing in frequency and severity due to climate change.<sup>217</sup>
- Increased atmospheric carbon dioxide results in a reduction in the levels of protein and micronutrients (e.g. calcium, zinc, iron) in important crops like barley, sorghum and soy.<sup>218</sup>
- Extreme weather events can prevent transportation of food products, disrupting food supply chains, increasing prices, and increasing loss due to spoilage.<sup>219</sup>
- Warmer temperatures increase the growth of *Salmonella*, *Camphylobacter*, *Rotavirus*, and various *Vibrio*, and harmful algal blooms, increasing the risk of food contamination.<sup>220</sup>

### Why Native Hawaiian and Pacific Islander Communities Are at Risk

- **Local Food Resources** – For communities living on these islands, local food systems rely on seasonal rainfall, which could be impacted by climate change, further reducing these communities’ access to local and healthy food sources.<sup>221</sup>
- **Pre-Existing Conditions** – Throughout the U.S. and Pacific Islands, the prevalence of obesity and diabetes is higher in Native Hawaiian and Pacific Island communities than the general public.<sup>222</sup> As climate change is expected to decrease nutritional value of foods while increasing wider food insecurity, the prevalence of these illnesses could increase in these communities, and individuals who have already been diagnosed will be even more vulnerable.

## Air Quality

See Section [4.4—Air Quality](#)

### Air Quality, Climate Change, and Health

- Climate change makes it ever more difficult to attain national air quality standards for ground-level ozone, a major component of smog, and is expected to cause increased exposure to particulate matter pollution in urban settings.<sup>223</sup>
- Common sources of greenhouse gas emissions (i.e. from motor vehicles and energy production) also produce many different air toxics, which are harmful to health.<sup>224</sup>
- Individuals with pre-existing chronic conditions, such as asthma, other respiratory disease, and cardiovascular disease, are at greater risk of disease exacerbations and complications due to air pollution.<sup>225</sup>

### Why Native Hawaiian and Pacific Islander Communities Are at Risk

- **Neighborhood** –A higher proportion of Pacific Islanders in the U.S. live in counties with pollution exceeding the federal air quality standards when compared with Asians and other racial groups.<sup>226</sup>
- **Pre-Existing Conditions** – Throughout the U.S. and Pacific Islands, the prevalence of asthma is higher in Native Hawaiian and Pacific Island communities than the general public.<sup>227</sup> Worsening air quality due to climate change is expected to worsen such conditions and increase their prevalence.

**Climate Resilience**

The impacts of climate change are a daily reality for Native Hawaiian and Pacific Islander communities and projected impacts threaten the very existence of their lands and culture into the future. These impacts echo into NHPI communities in the U.S., as individuals fear for their families living on these islands while also facing their own vulnerabilities due to climate change. Despite these challenges, Native Hawaiian and Pacific Islanders have strengths that foster climate resilience.

- Cultural identity and family ties can build resiliency in Native Hawaiian and Pacific Islander communities, building social cohesion and allowing communities to prepare together for impending threats.<sup>228</sup>
- Regional culture of communication and collaboration among Pacific Islands allows for better adaptation planning, as larger and smaller islands can collaborate to use their different strengths to confront climate challenges.<sup>229</sup>

## Appendix 4: Types of Greenhouse Gas Emissions

Table A4.1		GREENHOUSE GAS EMISSIONS: SOURCES, LIFETIMES, GLOBAL WARMING POTENTIAL		
Name	% of U.S. GHG Emissions 2016	Sources	Lifetime in the Atmosphere	Global Warming Potential (GWP)
Carbon Dioxide (CO <sub>2</sub> )	81 %	Electricity production, transportation, numerous industrial processes.	37.9	1
Methane (CH <sub>4</sub> )	10%	Livestock manure, food decomposition; extraction, distribution, and use of natural gas.	27.4	25
Nitrous Oxide (N <sub>2</sub> O)	6%	Vehicles, power plant emissions.	11.3	298
Black carbon (soot, PM)	> 1%	Diesel engines, wildfires, biomass in household cookstoves (developing countries).	13.3	3,200
Fluorinated gases: PFs, HFCs, NF <sub>3</sub> , SF <sub>6</sub>	3%	No natural sources. These are synthetic pollutants found in coolants, aerosols, pesticides, solvents, fire extinguishers. Also used in the transmission of electricity.	16.7	PFCs: 7,000-12,000 HFCs: 12,000-14,000 NF <sub>3</sub> : 17,200 SF <sub>6</sub> : 22,800

## Appendix 5: Climate and Health Considerations for Clinical Care Providers

# Table A5.1

## RECOMMENDATIONS REGARDING HEALTH RISKS, CLIMATE-RELEVANT PATIENT EDUCATION, AND CARE MANAGEMENT

### People with Asthma (See Section 6.4—Chronic Disease)

Climate-health risk	Climate-relevant patient education	Care management and coordination
<ul style="list-style-type: none"> <li>• Exacerbation of asthma symptoms and attacks related to:</li> <li>• High ozone levels due to rising average temperatures and extreme heat</li> <li>• Smoke exposure from wildfires</li> <li>• Mold exposure after flood events and extreme precipitation</li> <li>• Dust exposure with drought</li> <li>• More pollen exposure with longer, stronger allergy seasons</li> <li>• Reduced medication access and management with disruption and displacement after extreme weather events</li> </ul>	<ul style="list-style-type: none"> <li>• Advise patients to check the Air Quality Index and adjust outdoor activity on bad air days. <a href="http://airnow.gov/index.cfm?action=aqibasics.aqi">http://airnow.gov/index.cfm?action=aqibasics.aqi</a></li> <li>• For patients who smoke (or whose family members smoke), encourage them to quit and provide cessation support.</li> <li>• Educate patients to avoid climate-related asthma triggers: keep home and car windows closed on days with bad air from wildfire smoke, high pollen counts, dusty conditions; set home and car air conditioners to recirculate (close air intake); use HEPA air filters if available to decrease indoor air pollution.</li> <li>• Educate patients about indoor mold exposure; provide information about how to get help with home clean-up after flooding.</li> </ul>	<ul style="list-style-type: none"> <li>• Integrate reminders to check the Air Quality Index— especially on hot days—into asthma management plans.</li> <li>• Work with schools, camps, and childcare providers to integrate heat and ozone considerations into asthma management plans; advise them on adjusting outdoor activities when air quality is bad.</li> <li>• Work with public health and home visiting agencies to screen and refer for asthma-related risks in the home, e.g. leaky pipes, windows and doors; flood risk; proximity to polluting sources; need for home weatherization, air conditioning or fans; and windows or doors that are not sealed.</li> </ul>

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People with Diabetes (See Section 6.4—Chronic Disease)		
Climate-health risk	Climate-relevant patient education	Care management and coordination
<ul style="list-style-type: none"> <li>• Increased risk of heat illness due to rising average temperatures and extreme heat events</li> <li>• Insulin storage and disease management risks related to rising average temperatures and extreme heat events, and power outages or displacement following extreme weather events</li> </ul>	<ul style="list-style-type: none"> <li>• Educate patients about risks of heat illness and how to prevent it.</li> <li>• Educate patients about the impact of heat on insulin, proper storage of insulin and how to maintain adequate temperature control during extreme heat or evacuations.</li> <li>• Educate and refer patients to the Low Income Home Energy Assistance Program (LIHEAP) to facilitate assistance with energy costs.</li> </ul>	<ul style="list-style-type: none"> <li>• Work with cooling centers and shelters to ensure proper storage capability for insulin.</li> <li>• Work with public health and home visiting agencies to assess insulin storage capacity at home and resources for proper hydration.. and to screen and refer for heat risks in the home, including shades, fans, air conditioning, and windows or doors that are not sealed.</li> </ul>

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People with Cardiovascular Disease (See Section 6.4—Chronic Disease)		
Climate-health risk	Climate-relevant patient education	Care management and coordination
<ul style="list-style-type: none"> <li>• Increased risk of heat illness due to rising average temperatures and extreme heat events.</li> <li>• Increased risk of cardiovascular complications, including myocardial infarction and uncontrolled blood pressure, related to:               <ul style="list-style-type: none"> <li>◦ higher temperatures and impacts of heat on cardiovascular medications</li> <li>◦ ozone levels associated with higher temperatures</li> <li>◦ smoke and dust exposure associated with wildfires and drought</li> <li>◦ stress and/or medication management and access following extreme weather events</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Educate patients about their risks of heat illness and how to prevent it</li> <li>• Inform patients about the risks of some medications and heat.               <ul style="list-style-type: none"> <li>◦ Some medications, including medications to treat hypertension, heart failure or other cardiovascular disease, increase the risk of heat illness, while others lose their potency or result in adverse side effects related to heat: <a href="https://www.polkcountyiowa.gov/media/189984/medication-handout.pdf">https://www.polkcountyiowa.gov/media/189984/medication-handout.pdf</a></li> </ul> </li> <li>• Educate and refer patients to the Low Income Home Energy Assistance Program (LIHEAP) to facilitate assistance with energy costs.</li> <li>• Educate patients on the impacts of ozone and wildfire smoke on cardiovascular health. Advise them to check air quality levels during wildfires and to limit outdoor air exposure when air quality is poor.</li> <li>• If patients are sheltering in place due to wildfire, advise them to keep windows and doors closed, set air conditioners to recirculate (close air intake) and use HEPA air filters if available to decrease indoor air pollution.</li> </ul>	<ul style="list-style-type: none"> <li>• Work with public health and home visiting agencies to screen and refer for heat and air quality-related risks in the home, including shades, fans, air conditioning, and windows or doors that are not sealed.</li> </ul>

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**People with Mental Illness and Mental and Behavioral Health Considerations for all Populations (See Section 6.4—Chronic Disease)**

Climate-health risk	Climate-relevant patient education	Care management and coordination
<ul style="list-style-type: none"> <li>• Extreme weather events, including wildfire, drought, storms and floods:                             <ul style="list-style-type: none"> <li>◦ Increased risk of post-traumatic stress disorder, depression, suicide, anxiety, substance abuse and interpersonal violence following extreme weather.</li> <li>◦ Increased risk of complications related to medication access and management due to displacement.</li> </ul> </li> <li>• Heat:                             <ul style="list-style-type: none"> <li>◦ Increased risk of violence, aggression, suicide and hospitalization for those with mental illness.</li> <li>◦ Interactions between some psychotropic medications and heat increase the risk of adverse medication effects and/or heat illness.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Educate patients with mental illness about their risks of heat illness and how to prevent it</li> <li>• Inform patients about the risks of some medications and heat.                             <ul style="list-style-type: none"> <li>◦ Some medications, including psychotropic medications, increase the risk of heat illness, while others lose their potency or result in adverse side effects related to heat: <a href="https://www.polkcountyiowa.gov/media/189984/medication-handout.pdf">https://www.polkcountyiowa.gov/media/189984/medication-handout.pdf</a></li> </ul> </li> <li>• Talk to all your patients about climate change risks and associated mental health impacts, and refer them for mental health services, as well as social support services to mitigate stress related to the economic and social impacts of climate change, including e.g. LIHEAP home energy assistance, SNAP and WIC food assistance.</li> <li>• Educate and refer patients to the Low Income Home Energy Assistance Program (LIHEAP) to facilitate assistance with energy costs.</li> </ul>	<ul style="list-style-type: none"> <li>• Closely monitor patients during and after extreme heat and weather events, including drought, and assess for exacerbation of mental illness, heat illness or adverse medication effects.</li> <li>• Coordinate with local mental health service agencies to provide outreach, screening and referral for services during and after climate-related weather events (heat, extreme weather, drought).</li> </ul>

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Elderly		
Climate-health risk	Climate-relevant patient education	Care management and coordination
<ul style="list-style-type: none"> <li>• Increased risk of heat illness due to rising average temperatures and extreme heat events. Risk can be related to decreased thermoregulatory capacity, decreased mobility and/or decreased social connectivity.</li> <li>• Greater susceptibility to dehydration in heat and drought.</li> <li>• Increased susceptibility to air quality impacts such as ozone, smoke and dust exposure related to heat, wildfires and drought. Impacts include complications for asthma, COPD and other respiratory disease.</li> <li>• Elderly patients with limited mobility and/or social connections are at increased risk of injury, illness and death related to extreme weather events.</li> </ul>	<ul style="list-style-type: none"> <li>• Educate patients about their risks of heat illness and how to prevent it</li> <li>• Inform patients about the risks of some medications and heat. <ul style="list-style-type: none"> <li>◦ Some medications increase the risk of heat illness, while others lose their potency or result in adverse side effects related to heat: <a href="https://www.polkcountyiowa.gov/media/189984/medication-handout.pdf">https://www.polkcountyiowa.gov/media/189984/medication-handout.pdf</a></li> </ul> </li> <li>• Educate patients on how to avoid climate related triggers for respiratory disease: keep home and car windows closed on days with bad air related to wildfires, high pollen counts, dusty drought conditions; set home and car air conditioners to recirculate (close air intake) and use HEPA air filters if available to decrease indoor air pollution.</li> <li>• Educate and refer patients to the Low Income Home Energy Assistance Program (LIHEAP) to facilitate assistance with energy costs.</li> <li>• Educate patients about indoor mold exposure; provide information about how to get help with home clean-up after flooding.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor patients closely during periods of extreme heat or poor air quality, particularly those on heat-sensitive medications, those with limited mobility, cognitive impairment, or chronic illness such as diabetes, cardiovascular, renal, or respiratory disease.</li> <li>• Coordinate with public health nurses to integrate climate and health considerations into geriatric and home assessments, including screening for air conditioning, ventilation, shade, and whether they have an emergency plan and make referrals accordingly.</li> <li>• Coordinate with senior living and activity centers to develop heat and air quality protocols related to activity, nutrition, hydration, and medication management and safety checks with elderly patients.</li> </ul>

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Young Children (See Section 6.1—Maternal Health)		
Climate-health risk	Climate-relevant patient education	Care management and coordination
<ul style="list-style-type: none"> <li>• Increased risk of heat illness due to rising temperatures and extreme heat events</li> <li>• Increased risk of asthma and asthma exacerbation related to:               <ul style="list-style-type: none"> <li>◦ Higher ozone levels associated with rising temperatures.</li> <li>◦ Exposure to wildfire smoke.</li> <li>◦ Exposure to dust associated with drought.</li> <li>◦ Exposure to mold associated with storms, floods and increasing precipitation.</li> <li>◦ Sensitivity to longer, stronger pollen seasons.</li> </ul> </li> <li>• Increased risk of infectious disease from food, water, air and vector borne pathogens.</li> <li>• Increased risk of PTSD, anxiety, and learning and behavioral issues related to trauma and/ or displacement associated with extreme weather events.</li> <li>• Increased risk of malnutrition related to climate-associated food insecurity.</li> </ul>	<ul style="list-style-type: none"> <li>• Educate children and caregivers on climate risks and safety measures               <ul style="list-style-type: none"> <li>◦ Heat: Never leave children alone in a hot car or home; keep children hydrated by pushing fluids, or increasing breastfeeding frequency; modify or limit outdoor play; seek shade or cooling centers; dress children in loose, light clothing and do not swaddle infants in heat.</li> <li>◦ Air quality, including ozone, smoke, pollen, mold and dust: check the Air Quality Index (advise on interpretation and activity guidance); keep home and car windows and doors closed and recirculate air on bad air days or when traveling under wildfire or drought conditions; modify or limit outdoor play; assess and advise on any changes or modifications to asthma management plans for bad air days; signs of indoor mold and resources for mold remediation.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Ensure adequate vaccine storage and transport during heat events.</li> <li>• Monitor children with asthma closely during heat events and bad air days, assess and modify asthma management plans accordingly.</li> <li>• Monitor children closely during extreme heat events. Assess access to clean water, nutrition support, air conditioning or cooling centers.</li> <li>• Monitor children closely after extreme weather events and assess for symptoms of PTSD, learning or behavior difficulties. Coordinate with school, public health nurses and community health workers to provide mental health support and resources</li> <li>• Coordinate with community health workers, public health nurse and schools, camps or childcare providers to create heat and air quality protocols, and to integrate heat and air quality considerations into asthma management plans.</li> </ul>

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Young Children (See Section 6.1—Maternal Health)		
Climate-health risk	Climate-relevant patient education	Care management and coordination
	<ul style="list-style-type: none"> <li>○ Infectious disease: provide information on water safety alerts (harmful algal blooms, waterborne pathogens) for recreational water sources or during storms and floods; dress appropriately and use insect repellent when playing near heavily wooded or brush areas; emphasize good sanitation and food safety practices.</li> <li>○ Extreme events: advise families to create an emergency response plan, with special consideration for reunification; advise parents on signs and symptoms of PTSD, learning or behavior issues related to trauma from extreme events and provide resources for support.</li> <li>○ Nutrition: Advise and promote strong nutritional standards; provide resources for nutrition support (WIC, SNAP).</li> <li>● Educate and refer patients to the Low Income Home Energy Assistance Program (LIHEAP) to facilitate assistance with energy costs.</li> </ul>	

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Pregnant Women and Infants (See Section 6.1—Maternal Health)		
Climate-health risk	Climate-relevant patient education	Care management and coordination
<p><b>Heat and drought</b></p> <ul style="list-style-type: none"> <li>Increased risk of heat illness, dehydration, renal failure and infectious disease</li> <li>Increased risk of preterm birth, poor fetal growth, low birth weight, and infant mortality</li> <li>Air quality: wildfire smoke, higher ozone levels</li> <li>Increased risk of preterm birth, low birth weight</li> </ul> <p><b>Floods and storms</b></p> <ul style="list-style-type: none"> <li>Increased risk for waterborne disease</li> <li>Increased risk of anemia, eclampsia, spontaneous abortion, preterm birth, low birth weight</li> <li>Increased susceptibility to mold and environmental toxins.</li> </ul>	<ul style="list-style-type: none"> <li>Advise patients about the risks of extreme heat for pregnancy and how to stay safe, including information on hydration, exertion, cooling centers, and social support.</li> <li>Educate and refer patients to the Low Income Home Energy Assistance Program (LIHEAP) to facilitate assistance with energy costs.</li> <li>Advise patients to check the Air Quality Index (AQI) <a href="http://airnow.gov/index.cfm?action=aqibasics.aqi">http://airnow.gov/index.cfm?action=aqibasics.aqi</a> for unsafe ozone and particulate levels during hot days and in event of wildfires. Even if pregnant women live far from wildfire sites, smoke plumes can travel thousands of miles, so they should monitor air quality closely.</li> <li>Advise and assist patients to create an emergency response plan in case of need to evacuate, for example, in event of flood, wildfire, extreme weather or other emergent climate threat. For more information and guidance, visit the CDC site for <a href="#">emergency preparedness for pregnant women and infants</a>.</li> <li>Advise patients on the risks of illness from food, water and vector borne pathogens and to take appropriate precautions against illness:</li> </ul>	<ul style="list-style-type: none"> <li>Closely monitor pregnant patients during extreme heat events, on bad air days, during or after extreme weather events and assess for relevant climate-health risks.</li> <li>Coordinate with WIC, Black Infant Health, and public health nurses to integrate climate and health considerations into pregnancy and home assessments, including screening for air conditioning, ventilation, shade, window screens, vector habitat near the home, and whether they have an emergency plan. Make referrals accordingly.</li> </ul>

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Pregnant Women and Infants (See Section 6.1—Maternal Health)		
Climate-health risk	Climate-relevant patient education	Care management and coordination
	<ul style="list-style-type: none"> <li>○ Prepare all food with safe, clean water.</li> <li>○ Wear protective garments and insect repellent when outdoors near mosquito and tick habitats. Use screens on windows and doors at home to keep insects out.</li> <li>○ Recognize the symptoms of Lyme disease and Dengue.</li> <li>○ CDC Lyme Disease and pregnancy fact sheet: <a href="http://www.cdc.gov/lyme/resources/toolkit/factsheets/10_508_lyme-disease_pregnantwoman_factsheet.pdf">http://www.cdc.gov/lyme/resources/toolkit/factsheets/10_508_lyme-disease_pregnantwoman_factsheet.pdf</a></li> <li>○ CDC Dengue and pregnancy factsheet: <a href="http://www.cdc.gov/dengue/resources/educationMaterials/pdfs/15_261427-A_Seda_508_Update_Prevent_dengue_during_pregnancy508.pdf">http://www.cdc.gov/dengue/resources/educationMaterials/pdfs/15_261427-A_Seda_508_Update_Prevent_dengue_during_pregnancy508.pdf</a></li> <li>● Zika virus <ul style="list-style-type: none"> <li>○ Avoid travel to areas where there have been outbreaks of Zika virus: <a href="http://wwwnc.cdc.gov/travel/page/zika-travel-information">http://wwwnc.cdc.gov/travel/page/zika-travel-information</a></li> <li>○ CDC Zika and pregnancy site for patients: <a href="http://www.cdc.gov/zika/pregnancy/question-answers.html">http://www.cdc.gov/zika/pregnancy/question-answers.html</a></li> <li>○ For physicians: Doctor’s Visit Checklist for Pregnant Women who Traveled to an Area with Zika: <a href="http://www.cdc.gov/zika/pdfs/docvisit-checklist-travelpreg.pdf">http://www.cdc.gov/zika/pdfs/docvisit-checklist-travelpreg.pdf</a></li> </ul> </li> </ul>	

## Appendix 6: Personal Actions to Confront Climate Change

# Table A6.1

## PERSONAL ACTIONS TO CONFRONT CLIMATE CHANGE IN TRANSPORTATION, ENERGY, FOOD AND HOME



### Transportation

- When possible, walk or bike instead of driving.
- Drive low or no-carbon vehicles.
- Carpool with coworkers to work and meetings.
- Ensure your car tires are fully inflated and service your car regularly.
- Advocate for walking and biking infrastructure and public transit.



### Energy

- Purchase renewable energy if you can.
- Upgrade your appliances, electronics, and light bulbs to energy efficient models.
- Use power strips in your home and office, especially for large machines (i.e. home entertainment system, computers) to reduce phantom loads.
- Use programmable thermostats to reduce heating and cooling energy usage.
- Advocate for policies that support renewable energy.



### Food

- Eat less meat, especially beef.
- Eat fewer processed foods.
- Buy locally sourced, organic produce if you can.
- Support local farmer's markets and other local community food events.
- Reduce food waste in your home and when you eat out.
- Compost food scraps.
- Advocate for policies that support local, healthy, sustainable food systems.



### Home

- Wash clothes in cold water.
- Hang-dry clothes.
- Ensure your home is airtight with appropriate measures to prevent indoor air pollution.
- Recycle.
- Buy fewer items and products overall.

## For More Information

- *The Environmental Research Letter*, “[The climate mitigation gap: Education and government recommendations miss the most effective individual actions](#)”<sup>23</sup>
- Union of Concerned Scientist’s [Ten Personal Solutions to Global Warming](#)<sup>231</sup>
- NRDC’s [How You Can Help Fight Climate Change](#)<sup>232</sup>