



Alliance of Nurses for Healthy Environments



CLIMATE CHANGE, HEALTH, AND NURSING: A CALL TO ACTION

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Nurses at ANHE White House Summit, May, 2016

Executive Summary

Nurses are trusted health professionals in unique positions to inform and mobilize society to act on climate change. In May 2016, the Alliance of Nurses for Healthy Environments (ANHE), in partnership with the White House, held its first summit with national nurse leaders to discuss the critical importance of fighting climate change to protect the public's health.

This summit highlighted the crucial role of nurses as engaged leaders on climate action. Based on needs identified at the Summit, this report aims to inform nurses on the science behind climate change and health and inspire nurses to be leaders in helping our patients, our communities, and our health care institutions engage in climate change mitigation activities and in preparing for potential effects of climate change through adaptation strategies.

The earth's temperature is increasing, mainly due to human activities, leading to an increase in greenhouse gas emissions including methane, carbon dioxide, and nitrous oxide. These emissions come from energy production and use, transportation, industry (including healthcare), and agriculture. These changes are occurring globally at a rate that exceeds what the world has experienced over the last 650,000 years (Perry, et al, 2007). Health impacts can result from direct exposures to climate change through changing weather patterns or indirectly through changes in water availability, air quality, agriculture, and the economy. This report describes some of the more common health impacts including mental health issues, heat-related illness, water security and drought, insect-borne illnesses, and respiratory diseases, along with nursing's role in addressing these issues.

Costs of climate change on health have been slow to emerge in the research literature, resulting in substantial underestimates of climate change costs. Although the evidence is incomplete, findings suggest significant health costs. Groups sensitive to adverse health impacts from climate change include those living in poverty, the elderly, children, and indigenous populations. These sensitive groups together comprise a majority of the human population. By focusing on protecting these groups, we protect all of society.

Climate changes are expressed differently across the nation based on geography such as proximity to oceans and rivers; and underlying weather patterns including precipitation and storm trends. This report explores regional differences through case studies concluding with opportunities for nurses to reduce harm by mitigating and adapting to these changes. To describe the many ways nurses are leading the profession in addressing climate change, nurses' voices are highlighted through short video stories. As the nation's most trusted professionals, nurses can lead the charge to significantly improve society's response to climate change and foster the strategies needed for a healthy future for everyone.

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*The **Alliance of Nurses for Healthy Environments (ANHE)** is a national coalition of nursing organizations and individual nurses who believe that the environment and human health are inextricably linked. Our mission is to promote healthy people and healthy environments by educating and leading the nursing profession, advancing research, incorporating evidence-based practice, and influencing policy. Learn more about the ANHE at www.envirn.org*

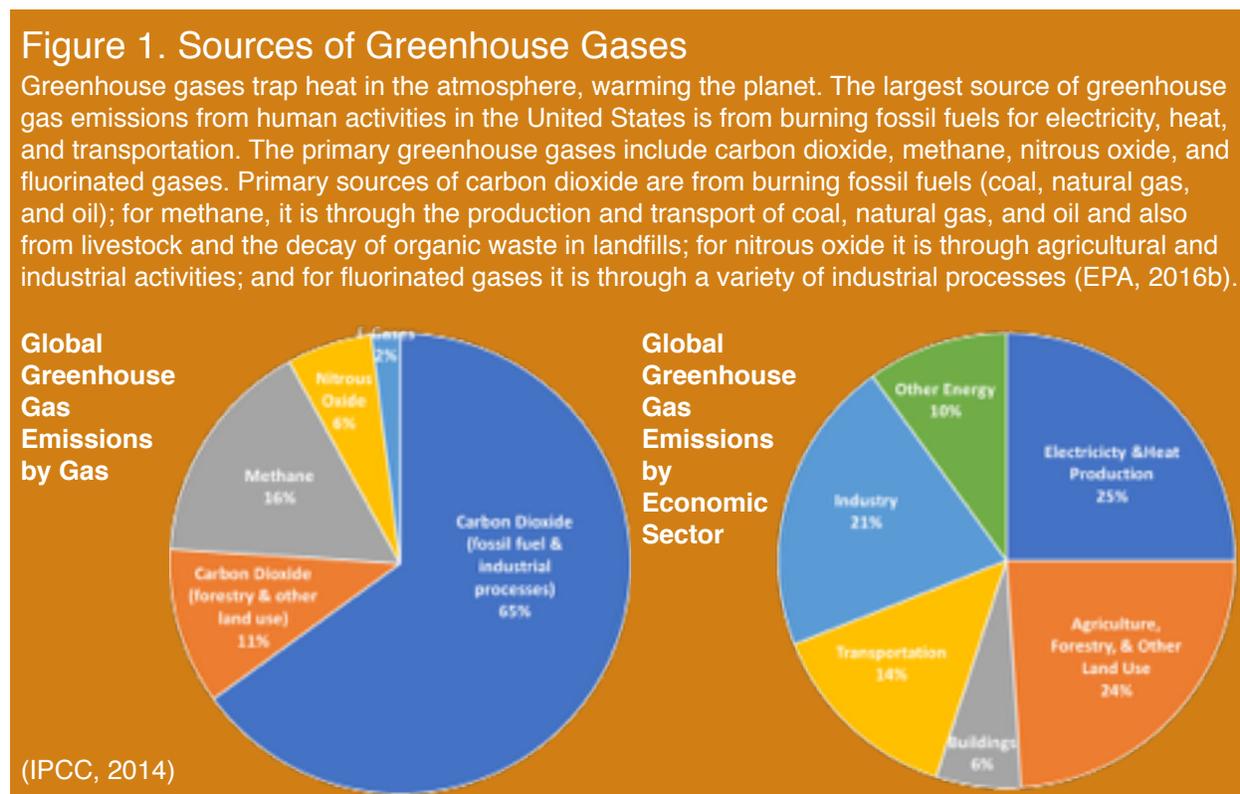
Introduction

Nurses are on the front lines caring for America’s health. We are the most trusted sources of information to the American public and we are in every community. We are in hospitals, clinics, schools, workplaces, nursing homes, and people’s homes. Due to our unique position within healthcare and our communities, on May 25th, 2016, the White House, in partnership with the Alliance of Nurses for Healthy Environments (ANHE), hosted representatives from leading national nurses’ organizations to discuss the critical importance of fighting climate change to protect public health.

In light of the current and predicted health threats from climate change, this historic event focused on how nursing organizations can address this public health crisis. Nurses educate their members, lead research, incorporate climate change into nursing practice and education, and participate at the local, state, and federal levels on climate policies like the Environmental Protection Agency (EPA)’s Clean Power Plan, which sets the first national limits on carbon pollution from power plants.

Climate change is causing extended heat spells; both flooding and droughts across the country; extreme weather events; larger and hotter forest fires; and threatened food crops. There is a wide range of human health, safety, and mental health threats posed by the impacts of climate change.

With this report, we aim to inform nurses on the science behind climate change and health. Our hope is to inspire nurses to be leaders in helping our patients, our communities, and our health care institutions engage in climate change mitigation activities and in preparing for potential effects of climate change. We are in a very critical time in history; we need all nurses’ hands, minds, and hearts on deck as we address the challenges posed by climate change.



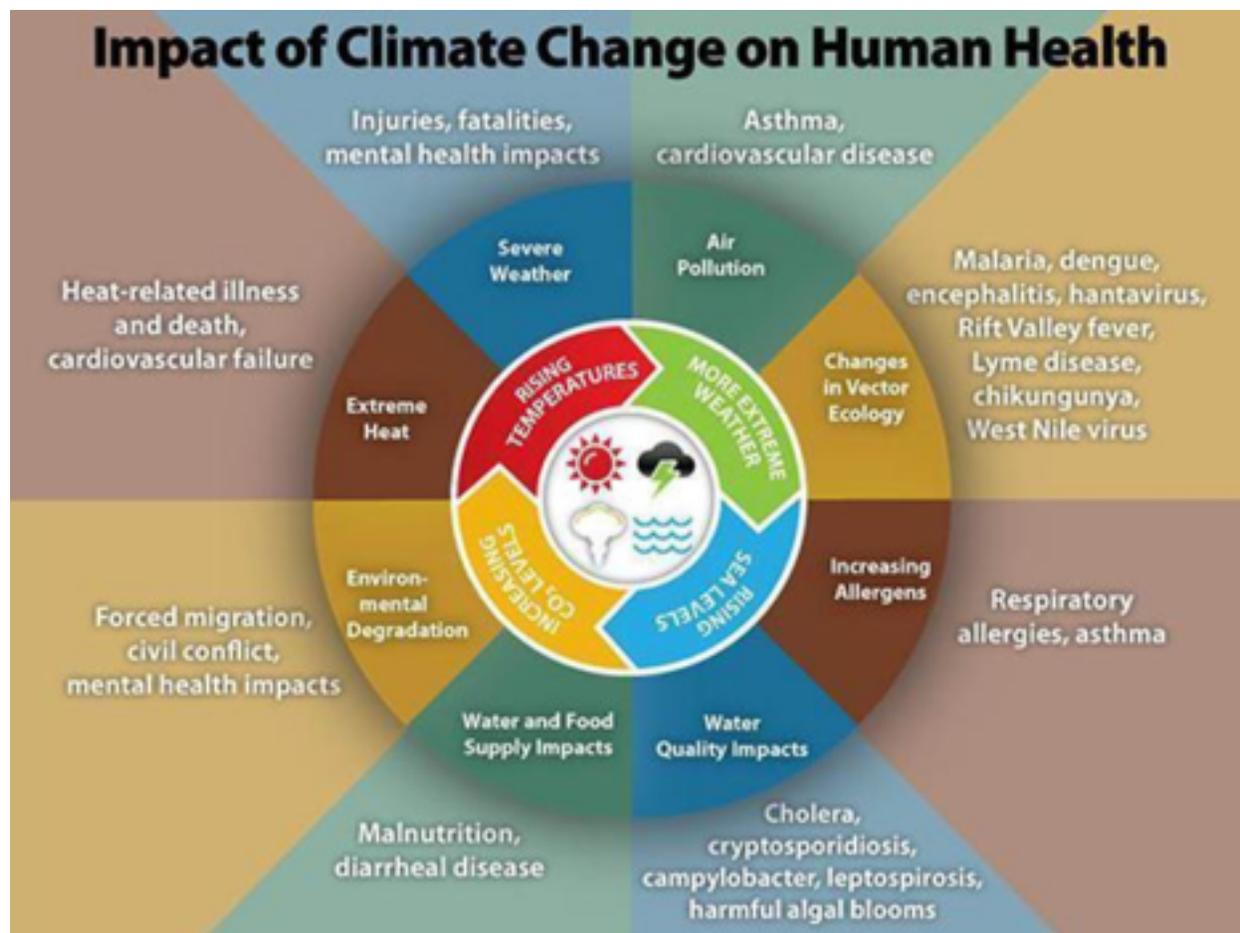


Figure 2. Impact of Climate Change on Human Health (CDC, 2016)

Review of the Science

The earth's temperature is increasing mainly as a result of human activity, such as burning fossil fuel leading to an increase in greenhouse gas emissions including methane, carbon dioxide, and nitrous oxide. These emissions come from energy production and use, transportation, industry (including healthcare), and agriculture. These changes are occurring globally at a rate that exceeds what the world has experienced over the last 650,000 years (Parry et al., 2007).

Climate change leads to extreme weather events such as heat waves, melting of snow and ice with rising sea levels, changes in precipitation resulting in flooding and drought, more intense hurricanes and storms, wildfires, as well as poorer air quality. Climate change impacts agriculture, infectious disease, allergies, and livelihoods. There is growing evidence and concern about the impacts of climate change on health and how to respond to these impacts.

Health Impacts of Climate Change

Health impacts can result from direct exposures to climate change through changing weather patterns (e.g., heat waves) or indirectly through changes in water availability, air quality, and resultant changes in agriculture and the economy. Figure 2 (CDC, 2016), provides information based on the Third National Climate Assessment, describing the wide-ranging health impacts

from climate changes such as rising temperatures, rising carbon dioxide levels, rising sea levels, and more extreme weather (CDC, 2016). Some of the more common climate changes and related health impacts are described.

Heat-Related Illness

Average global temperatures are increasing and are this trend is expected to continue. Health consequences of increasing global temperatures include rising rates of heat stress and exhaustion, heat cramps, heat stroke, and death. With the anticipated increase in intensity and frequency of extremely hot weather events the impact on human health is expected to rise dramatically (Amengual, Homar, Brooks, Ramis, Gordaliza & Alonzo, 2014). Heat-related mortality in US cities is expected to more than double by the mid- to-late 21st century (Stone, Vargo, Habeeb, DeLucia, Trail, Hu & Russell, 2014). In the U.S., extreme heat events already cause more deaths annually than all other extreme weather events combined (Portier & Tart, 2010). Much of the excess mortality from heat waves is concentrated in infants, children, and those with chronic illnesses and those over 65 (Amengual, Homar, Brooks, Ramis, Gordaliza & Alonzo, 2014; Haines & Patz, 2004; Portier & Tart, 2010). Those living in urban environments are at added risk because of heat trapping materials used in the construction of roads and buildings such as concrete. Additionally, cities lack significant tree cover, exacerbating the high temperatures. Cities frequently experience ambient air temperatures from 1.8–5.4°F (1–3°C) warmer than the surrounding rural and suburban areas. This “urban heat island” also absorbs heat during the daytime and radiates it outward at night, raising nighttime minimum temperatures by 22°F (12°C) (Environmental Protection Agency (EPA, 2011a).

Water Security and Drought

Water security or the reliable availability of water for drinking, agriculture, manufacturing, and many other uses, is essential to human health. However, floods and droughts that result from climate change can dramatically impact water availability and surface water quality (Delpla et al., 2009). In Southern U.S. states, droughts have become a more frequent occurrence; Western states have experienced water shortages worsened by reduced mountain snowpack attributable to global warming (Portier & Tart, 2010).

Insect-Borne Illnesses

Many major infectious disease agents (such as bacteria and viruses) and the vectors or organisms that carry them (e.g. mosquitoes) are highly sensitive to temperature and rainfall (Patz, Campbell-Lendrum, Holloway & Foley, 2005). Warming trends have impacted the range and incidence of vector borne diseases. As environmental conditions change, the geographic range of the vectors for illnesses is extended, increasing the potential for infection. Changes in climate may make insect-borne diseases harder to control. For example, as temperature increases, the malaria parasite reproduces at a higher rate and mosquitoes feed more frequently.

Respiratory Disease

By 2020, it is predicted that health impacts from climate change and ozone pollution will result in significant increases in acute respiratory symptoms, asthma-related emergency room visits, weather-related hospital admissions for infants and the elderly, lost school days, and premature deaths (Costello et al., 2011). Small changes in temperature (a degree or two) coincide with increasing ground-level ozone and, with it, a significant effect on death rates. An estimated 3,700 deaths annually can be attributed to these small increases in ozone levels (Bell et al., 2004; Bell et al., 2008; Perera & Sanford, 2011). Climate change and resulting air pollution poses a serious threat to respiratory health (Babin et al., 2007; Ebi et al., 2006; Ebi & McGregor,

2008; Parry et al., 2007). Global warming has caused an earlier onset of the spring pollen season in the Northern Hemisphere (Metz et al., 2007) and increased the production of allergens (e.g., ragweed). Temperature increases and increased carbon dioxide (CO₂) concentrations produce earlier flower blooming, affecting the timing and distribution of allergens such as pollen. It is anticipated that respiratory allergies and asthma will become more common and severe because of increased exposure to pollen, molds, and air pollution as a result of climate change (D'Amato et al., 2010; Ebi et al., 2008).

Mental Health

Climate change may affect mental health directly by exposing people to trauma (Berry, Bowen & Kjellstrom, 2010). Adverse psychiatric outcomes are well documented in the aftermath of natural disasters (Page & Howard, 2010), and can include both acute traumatic stress and more chronic stress-related conditions (such as post-traumatic stress disorder). Extreme heat events, which are becoming more common, have been associated with a general increase in aggressive behavior, higher rates of criminal activity, and increased suicide rates (Berry et al., 2010). There will likely be an increase in the overall burden of mental disorders worldwide as extreme weather conditions and natural disasters can lead to displacement, loss, and social disruption. Those who are already vulnerable to stress-related disorders and mental health disease are at even higher risk following extreme weather conditions.

Vulnerable or sensitive groups together comprise most of the members of the human population. By focusing on protecting them, we protect all of us.

Financial Impacts

Emerging research indicates that the costs of climate changes are substantial. A study in 2010 found that economic losses from climate-related disasters, not including health care costs, had soared from \$5 billion to \$27 billion US dollars annually from 1970 to 2010 (Reichenmiller, 2010). Recent estimates indicate that climate change and weather disasters in 2012 cost the American economy more than \$100 billion (EPA, 2016).

Costs of climate change on health have been slow to emerge in the research literature, with limited inclusion in valuations of climate change damages, resulting in substantial underestimation of climate change costs (Knowlton, 2011). Although the evidence is incomplete, findings suggest significant health costs (Hutton, 2011).

A study investigating six climate-related events found that health costs from premature deaths and illness surpassed \$14 billion between 2002 and 2009. These six events included ozone smog pollution, heat wave, hurricane, wildfire, mosquito-borne infectious disease, and river flooding (Knowlton, 2011).

In an often-overlooked cause of greenhouse gases, Springmann et al. (2016) found that moving toward more plant-based diets from animal-based diets (a source of methane gas) could reduce global mortality by 6–10% and food-related greenhouse gas emissions by 29–70% in 2050. The economic benefits of moving to plant-based diets was found to be \$1–31 trillion US dollars, in 2050.

The benefits of health adaptation strategies are difficult to measure. Environmental health interventions cannot be evaluated within the same framework as other health interventions,

which have a more narrowly defined scope and range of costs and benefits. Many impacts are intangible or difficult to measure such as a reduction in the quality of life (Hutton, 2011). Economic evaluations of environmental health interventions such as adaptation are highly uncertain, due to methodological difficulties, lack of reliable data and an inability to generalize findings across settings (National Environmental Health Council, 2016).

Despite these difficulties there has been some research conducted on health adaptation strategies. In one study, it was found that the cost of running a heat–health warning system for Philadelphia was relatively small (US \$210,000) compared with the benefits of saving lives (US \$468 million) (Ebi et al., 2004).

A final consideration is the impact of policies on the costs and benefits related to climate changes. One policy that has been studied is the Clean Air Act. The EPA found that in 2010, approximately \$1.3 trillion dollars was gained in public health and environmental benefits as a result of Clean Air Act amendments for a cost of \$50 billion dollars (Johnson, 2011). The EPA estimates that in 2020, the US will experience a gain of approximately \$2 trillion dollars in benefits at a cost of \$65 billion dollars.

A series of studies found that implementing the Clean Air Act actually increased the size of the economy through improved health and a more productive workforce. This resulted in an increased net economic output (Goodstein et al., 2010; EPA, 2011b; Jorgenson et al., 2004). Jorgensen et al. (2004) found that by 2010, the Gross Domestic Product (GDP) was approximately 1.5 percent higher than expected as a result of the Clean Air Act.

More recently, the Clean Power Plan is predicted to prevent 2,700 to 6,600 premature deaths and 140,000 to 150,000 asthma attacks in children, leading to climate and health benefits worth \$55 billion- \$93 billion dollars per year by 2030 (EPA, 2016).

Health Disparities

Though all humans are at risk from impacts from climate change, some groups and individuals are at higher risk. This health disparity is an important consideration in identifying and decreasing likely harm.

Around the world, the poor are at higher risk for damage from storms, flooding and drought, infectious disease, and pollution. The poor have fewer resources for adequate housing, food security and sometimes education. In addition, the poor are likely to live in countries, regions or neighborhoods with less infrastructure such as emergency response, food banks, back-up housing and healthcare. People in poverty may feel less empowered to advocate for better preparedness in their communities. These elements put them at higher risk for disease, injury or displacement that may result from climate change impacts (Luber, et.al, 2014).

Indigenous people are also at higher risk (Bennet, et.al, 2014). Native peoples in many places subsist off the land for wild food and crops, for cultural items, and for housing. Each of these are threatened with climate change. In the north, Alaska Native communities are threatened with damage to infrastructure due to loss of permafrost, and loss of communities due to sea level rise. In the southern US, desert native communities are at increased risk of drought and heat.

Urban elderly people may be at-risk. In cities, elderly may live in older homes or apartments, some without adequate ventilation as temperatures rise. They may be more isolated, and it may be challenging to leave their homes and reach help. Elderly people may be more sensitive to

heat and susceptible to dehydration. They are more likely than younger people to have co-morbidities which may then be exacerbated by increased heat and air pollution. They are also more likely to be on medications whose actions may be altered by heat.

Children around the world are more at risk to climate change impacts (Harvard, 2016). Infants can be quite sensitive to heat, dehydration, pollution, and infection. Children of all ages are more impacted by pollution, trauma, dehydration, and starvation than healthy adults.

Women are more impacted than men in several aspects. Smaller body size on average may increase sensitivity to heat, dehydration, and pollution. Women are often the primary providers of care for infants and children, thus their health impacts the health of others. Climate change impacts may put women more at risk of disease, malnutrition, dehydration, injury, sexual violence, mental health challenges, obstetrical difficulties, and death.

People of all ages with underlying disease are at increased risk due to climate change. People with cardiac disease, including coronary artery disease and congestive heart failure, are at higher risk during heat events and pollution events. People with asthma, COPD and lung disease are at risk during high temperatures, increased ground level ozone, and forest fires. People with diabetes or obesity are at higher risk of morbidity and mortality during heat waves. In addition, climate change may increase the risk of diabetes as it interrupts healthy food systems and makes mobility more difficult.

Regional Highlights: Climate Change and Health

Climate change causes many different impacts, stemming primarily from the warming of the globe and its downstream effects. We see increased heat, changes in precipitation and available moisture, and movement of infectious disease vectors to niches where they have not previously been. We see increased air pollution, worse storms, and challenges to health and mental health. These impacts from climate change are expressed differently across the nation based on geography such as altitude; proximity to oceans and rivers; underlying weather patterns including precipitation and storm patterns; and infrastructure that may influence vulnerability.

In the following section, each of eight regions across the US will be addressed, moving from east to west: Northeast, Southeast, Midwest, Great Plains, Northwest, Southwest, Alaska, and US Islands. The key climate-related risks in each region will be described, followed by an example of challenge or success and a description of how nurses can be engaged to decrease harm.



Figure 3. US Map of National Climate Assessment Regions (EPA, 2016d)

Extreme Weather in the Northeastern United States

The 12 northeastern states form a high-density urban coastal corridor from Washington, D.C., north to Boston in which 64 million people are concentrated. While the northeastern states include diverse built and natural environments, they all include populations that have been shown to be highly vulnerable to climate hazards and other stresses. The northeastern states depend on aging infrastructure that has already been stressed by climate hazards including heat waves, as well as coastal and riverine flooding due to a combination of sea level rise, storm surge, and extreme precipitation events. The Northeastern United States is frequently impacted by extreme weather events such as ice storms, floods, droughts, heat waves, hurricanes, and major storms in the Atlantic Ocean off the northeast coast, referred to as nor'easters (Melillo et al., 2014).

Between 1895 and 2011, temperatures in the Northeast increased by almost 2°F (0.16°F per decade), and precipitation increased by approximately five inches, or more than 10% (0.4 inches per decade) (Kunkle, Stevens, Sun, Janssen, Wuebbles, et al., 2013). Coastal flooding has increased due to a rise in sea level of approximately 1 foot since 1900. This rate of sea level rise exceeds the global average of approximately 8 inches. The Northeast has experienced a greater recent increase in extreme precipitation than any other region in the United States. Between 1958 and 2010, the Northeast saw more than a 70% increase in the amount of precipitation falling in very heavy events (defined as the heaviest 1% of all daily events) (Groisman, Knight & Zolina, 2013).

While the intensity, duration, and frequency of cold air patterns is expected to decrease in the northeastern states, winter and spring precipitation is projected to increase (Liu, Curry, Wang, Song, & Horton, 2012). As the century progresses, the frequency of heavy downpours is projected to continue to increase. As temperatures rise, leading to greater evaporation and earlier winter and spring snowmelt, in the Northeast so will seasonal drought risk. It is projected that by 2100, sea levels will rise one to four feet. However, sea level rise along most of the coastal Northeast is expected to exceed the global average rise. The frequency of dangerous coastal flooding throughout most of the Northeast would more than triple with a sea level rise of two feet, in the absence of any changes in storms. Although individual hurricanes cannot be directly attributed to climate change, Hurricanes Irene and Sandy demonstrated the vulnerability of the Northeastern United States to extreme weather events and the potential for adaptation to reduce impacts.

Case in Point

In October, 2012, Hurricane Sandy impacted 14 US states and Washington, DC, causing particularly severe damage in New York and New Jersey. Hurricane Sandy was the second costliest hurricane in US history, resulting in 43 fatalities and thousands of injuries (Gibbs & Holloway, 2013). Flooding and power outages from the storm necessitated the evacuation of hospitals, skilled nursing and assisted living facilities. In New York City, approximately 6,300 patients had to be evacuated from 37 health care facilities. Widespread power outages forced hospitals to rely on backup generators, which subsequently failed because of flooding. When health care facilities evacuated, neighboring institutions received the displaced patients (Adalja et al., 2014).

Restoring the facilities took months at massive costs. Superstorm Sandy resulted in the loss of 15% of the total bed capacity in New York City. Five hospitals were completely closed and 5,000 nursing home were also lost, severely testing the limits of the regional health care system for weeks and months beyond the event itself.



Figure 4. Spaulding Rehabilitation Center; Steinkamp Photography, courtesy Perkins + Will. Spaulding Rehab is on the water where the Little Mystic Channel meets the Inner Boston Harbor. Many of the hospital's resilience features were implemented in response to flooding risk.

One northeastern hospital, Spaulding Rehabilitation Hospital (SRH) in Charlestown, Massachusetts, has been designed with climate change in mind. Based on lessons learned in Hurricanes Sandy and Katrina about the need to build resiliency into hospital planning and operations, Spaulding Rehabilitation Hospital, while located on the waterfront, will be able to continue operations in the event of extreme weather events, storm surge or sea level rise. The hospital was designed to protect patients and employees from the effects of extreme weather and long-term climate change and maintain basic building systems and services for a period of at least four days from the onset of an emergency.

Informed by the experiences of hospitals in New Orleans during Hurricane Katrina, SRH was built much higher than was required by building codes. The first floor of the hospital is 30 inches above the 500-year flood elevation, keeping water out even with a catastrophic flood. This was done because hospital leaders recognized that sea level rise would change flood elevations in the years to come and thus the hospital would be protected.

While both Hurricanes Sandy and Katrina left hospitals without power and air conditioning, Katrina left hospitals without power or air conditioning with temperatures above 100°F in the hospitals. Since evacuating patients in Hurricane Katrina was impossible, hospital staff was forced to break windows to get fresh air into the building. At SRH, windows are key-controlled and can be opened in an emergency.

SRH is designed and built to provide for *sheltering in place* by providing passive survivability, the ability to maintain livable conditions in the event of lost power or heating fuel. The entire first floor of the hospital can be flooded with only minor damage and while enabling the upper floors of the building to remain fully occupied and operational. So that the hospital can remain operational in the most extreme weather events, all mechanical and critical infrastructure of SRH is located on the roof or a penthouse floor above the eight hospital floors.

What Can Nurses Do?

It is imperative that nurses are prepared in disaster preparedness in areas prone to flooding and hurricanes that can lead to a disruption in community infrastructure and services. The University of Miami School of Nursing and Health Studies has a program that prepares nursing students to be prepared in addressing the health impacts of climate change. It has implemented a requirement for students to be certified in disaster preparedness: <http://climate.miami.edu/impact-on-health/nurses-at-the-ready/>. Students receive National Incident Management System (NIMS) and Incident Command System (ICS) certifications and are ready to deploy with the Medical Reserve Corps.

Flooding in the Southeast

The Southeast region of the US is made up of a diversity of ecosystems and climates, spanning from the coastal plains of the east to the Appalachian Mountains in the west. There are more than 80 million people living in this region, with populations clustered in major cities such as Miami, New Orleans, and Atlanta and 11 of the fastest growing metropolitan areas in the country are found in the Southeast (EPA, 2016c).

The majority of states in this region have coastlines on either the Atlantic Ocean or the Gulf of Mexico, with over 29,000 miles of coastline in this region. This puts the region at risk from increasingly intense hurricanes, sea level rise, and storm surges.

Sea level rise is being caused by both the warming of the oceans, causing the water to expand, and melting of land ice such as glaciers and ice caps which are adding to the ocean's waters, and by coastal land sinking (subsidence) (Carter, et.al., 2014). Some coastal cities and towns, such as Miami, are already experiencing more frequent flooding during high tides and heavy rainfall. For example, an analysis by the University of Miami (Wdowinski, et. al., 2016) found that since 2006, flooding in Miami Beach had increased 400 percent from high tides and 33 percent from rain. Flooding damages essential infrastructure, can increase



Figure 5. Watch:Tidal Flooding and Sea Level Rise: The Growing Impacts of Global Warming at www.youtube.com/watch?v=G-fZnIR_IJQ (UCS, 2014)

risks of mold growth in structures, increases standing water that can lead to increases in mosquito populations, and contaminates freshwater supplies (EPA, 2016c).

Temperatures and heat waves are also on the rise in the Southeast. Human health impacts of these increased temperatures include increased risk of heat stress and heat-related deaths as well as negative respiratory impacts. Increased temperatures also contribute to the formation of ground level ozone. Ground level ozone is predicted to increase in the 19 largest metropolitan areas in the Southeast. Increased ozone levels could lead to increased hospital admissions for respiratory issues; increased emergency room visits for asthma, respiratory impacts, and cardiac events; and more days lost from school for kids with asthma.

Case in Point

In October 2016, Miami and surrounding areas experienced what is called a King Tide, the highest tide of the year. While coastal communities are obviously impacted, low-income communities farther inland are also feeling the impacts of these high tides. These tides are causing significant flooding across communities with roadways being flooded with saltwater during high tide. The scientists at Union of Concerned Scientists are predicting that by 2045, some of these communities will be experiencing high tide flooding up to 380 times a year, sometimes twice a day (UCS, 2016).

Miami-Dade County has been investing over \$400 million towards climate change adaptation through new drainage systems and pumps to facilitate drainage when flooding occurs. However, lower income communities may be slower to receive these infrastructure improvements as cities focus their energies on saving expensive waterfront real estate.

There is a great opportunity for lower-income communities to be involved in the planning as these adaptation efforts continue, in order to make sure their communities are included in plans moving forward. Also, public health professionals, such as nurses and community health workers can play a vital role in preventing disease and contamination that can occur with flooding. These efforts can include education on reducing standing water to prevent increases in Mosquito populations. Education on the health impacts of mold growth that can occur following flooding as well as safe mitigation techniques should be included. Flood waters can contain high levels of sewage and fecal matter (Staletovich, 2016) as well as chemical contaminants found on roadways such as oil and gasoline, so educating residents on ways to reduce exposures is essential.

What can Nurses Do?

Nurses are excellent educators and advocates. They are poised to provide communities with the information they need to decrease the health impacts of flooding:

- Public health nurses, who are already in the community, can ensure that all impacted communities are involved in decision-making around flood mitigation efforts
- Educate community members on ways to reduce standing water and thus decreasing mosquito populations without the use of toxic pesticides
- Educate the community on ways to reduce water-borne exposures
- Work with local, state, and federal policymakers on efforts to mitigate flooding. Many times the nursing perspective is missing from these conversations.

Heat Waves in the Midwest

The frequency of major heat waves in the Midwest has increased over the last six decades. In the US, extreme heat events already cause more deaths annually than all other extreme weather events combined (Portier & Tart, 2010). In the US, mortality increases 4% during heat waves compared with non-heat wave days (Pryor, et.al, 2014). Much of the excess mortality from heat waves is concentrated in infants, children, those with chronic illnesses and those over 65 (Amengual, Homar, Brooks, Ramis, Gordaliza & Alonzo, 2014; Haines & Patz, 2004; Portier & Tart, 2010).

Health impacts from extreme heat events include increasing rates of heat stress and exhaustion, heat cramps, heat stroke, and death. It is thought that statistics for illness and deaths attributable to heat are significantly underestimated, since prolonged exposure to heat can aggravate pre-existing cardiovascular and respiratory conditions, indirectly resulting in additional illness and deaths.

With the anticipated increase in intensity and frequency of extremely hot weather events, the impact on human health is expected to increase dramatically (Amengual, Homar, Brooks, Ramis, Gordaliza & Alonzo, 2014; Portier & Tart, 2010; Stone et al., 2014). More than 61 million people live in the Midwest region, primarily in cities (e.g., Chicago, Detroit, and Milwaukee) (Pryor, et.al, 2014). Those living in urban environments are at added risk because of heat trapping materials used in the construction of roads and buildings. Additionally, cities lack significant tree cover, exacerbating the high temperatures. Cities frequently experience temperatures that are substantially warmer than the surrounding rural and suburban areas. This “urban heat island” also absorbs heat during the daytime and radiates it outward at night, raising nighttime minimum temperatures by 22°F (12°C) (Environmental Protection Agency (EPA), 2011a).

Case in Point

One of the deadliest heat waves in US history happened in Chicago in July 1995. A severe heat wave hit the city, when temperatures reached 106 degrees with a heat index of 126 degrees, resulting in 739 deaths and thousands hospitalized over a five-day period. Most of the victims of the heat wave were the poor, elderly who lived alone, did not have air conditioning and did not open windows for fear of crime (Dematte, et. al, 1998).

Despite warnings from the National Weather Service, City Hall had not implemented its heat emergency plan missing an opportunity to prevent heat related deaths. City Hall had:

- Not immediately recognized the public health emergency
- No official plan for heat emergency response
- Not recognized vulnerabilities of poor, elderly residents such as social isolation and lack of air conditioning
- Not issued public advisories
- Not opened cooling centers (Klinenberg, 2002).

Lessons were learned from the disaster in Chicago. A heat wave in Chicago in 1999 resulted in fewer deaths due to an aggressive city response that included community workers checking on the elderly and taking them to cooling centers. It has been projected that there will be an

increase of between 166 and 2,217 excess deaths per year from heat wave-related mortality in Chicago alone by 2081-2100 if adaptation plans are not in place (Peng et al., 2011).

Although heat response plans and early warning systems save lives, many cities lack such plans. Successful plans and systems have focused on establishing partnerships between city departments, public utilities and the National Weather Service. Community resilience toolkits are available, including one on extreme heat that can be used by nurses to educate the public (See resources.)

What Can Nurses Do?

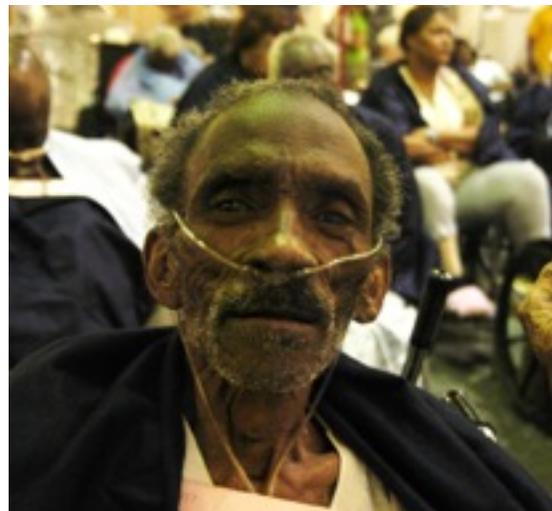
Nurses must be involved in supporting the development of heat action plans for their communities. Initial research has found that early-warning systems to alert community members are an effective way to reduce and prevent heat stress during heat waves. This will require the creation of formalized lines of communication among public health officials, hospitals, government agencies, media, emergency response teams, and community groups (Ebi et al., 2004). In addition, the availability of cooling centers is an important consideration for communities with limited access to air conditioning during extreme heat events. Nurses can advocate for the establishment of cooling centers, in addition to learning about available resources to those who do not have air conditioning in their homes (e.g., public spaces such as libraries).

As trusted health professionals, nurses are integral in building public awareness on the risks of heat waves and practices to prevent heat-related illnesses. These can be accomplished through social media messaging, brochures, and media outlets on heat-stress prevention tips.

- Those at risk include the elderly, children, people who work outdoors, homeless, socially isolated, using certain medications, and low-income populations
- Recognition of symptoms of excessive heat exposures includes dizziness, nausea, confusion, muscle cramps
- Awareness of response and treatment actions include staying hydrated, seeking air conditioned settings

Impacts on Agriculture in the Great Plains States

The Great Plains states extend from the Canadian border to the Mexican border, from Montana to Texas. There is wide variability in precipitation, temperatures, elevation, and population in these states. For instance, in the western dryer states of Montana and Wyoming, average annual precipitation is 14-16 inches. In the wetter southern states of Oklahoma and Texas, precipitation can be over 50 inches per year. Similarly, temperatures vary greatly over this north-south distribution. In



The elderly are particularly sensitive to heat waves that impact air quality and respiratory diseases. The heat can also effect how well some drugs perform.

Photo: Liz Roll/FEMA

each area, however, global warming brings changes. However, one characteristic they share is a preponderance of agricultural areas, utilizing more than 80% of the land in both crops and livestock (USDA, 2016).

Whether it is less precipitation, leading to drought, or more precipitation, leading to flooding, agriculture can be impacted. Changes in temperatures and moisture can worsen pests and invasive weeds. Rising temperatures impact agriculture as well. In the short run, northern growers may experience beneficial longer growing seasons, while southern growers may experience stressed crops. Over the long run, as temperatures and water stresses increase, there may be a northward shift in crop viability. Additionally, there is likely to be more variability (or less reliability) in crop production, yields and nutritional value of grains.

Livestock growing is very water intensive. Additionally, heat stresses the animals and may cause declines in production of meat, eggs, and milk. Stressed animals are more prone to infection and disease, which can cause hygiene challenges for humans. Parasites can become stronger and more prolific with longer growing seasons and changes in rainfall.

Each of these elements can impact the economic viability of agriculturalists, which can in turn lead to community, family, and individual stress. Agricultural communities are accustomed to adapting to weather, but the long-term trends of global warming increase the risks. Studies in long term drought stricken communities have identified stress and the effects of stress on individuals and communities. This is leading some communities to adopt more resilient and sustainable practices to adapt to the changing climate.

Case in Point

In 2016, an economic analysis of agriculture in Montana estimated \$736 million was lost annually by mid-century due to climate change (Powers & Powers, 2016). Increased heat and changing patterns in precipitation will impact the crops that are raised, as well as will cause stresses to livestock. An innovative solution has been underway for the past few decades, and is chronicled in the book Lentil Underground (Carlisle, 2015). Dry land farmers, frustrated with year after year of drought slowly evolved their farming practices to grow soil nourishing legumes, including beans, lentils, and other nitrogen-fixing crops. Not only did it require bold steps in practice, but it also required cultural changes amongst dry-land wheat and barley farmers who found themselves growing drought resistant, organic crops of items they have never tasted. The adaptability shown by the farmers, seller and buyers is a hopeful example of adaptation to a changing climate.



Figure 6. Flooding in agricultural areas
<http://climate.nasa.gov/effects/>



Figure 7. Drought in agricultural areas
<http://climate.nasa.gov/effects/>

What Can Nurses Do?

Like farmers, nurses are often cornerstones of their communities. Nurses can take note of the health risks associated with the changing climate in the Great Plains States. Nurses can advocate for drought relief, for sustainable farming practices, and for support networks to address food insecurity. Nurses can serve as educators, teaching others in the community about the impacts of climate change and subsequent health risks.

Forest Fires in the Pacific Northwest

The Pacific Northwestern States are heavily forested. Drought in this area has increased over recent decades with higher temperatures, lower precipitation and earlier snowmelt in the spring. (NIFC, 2015). These shifts in available moisture increase the risk for wildfire. Since the mid-1980's, forest fires have increased by 300% (Preisler & Westerling, 2007). The increase in large wildland fires particularly impacts heavily forested states, including Washington, Oregon, California, Idaho, Montana, Colorado and Alaska. Not surprisingly, this trend is changing the health risks for humans who live in these areas. Forest fires contribute several important health risks, especially to vulnerable populations. Some of these health risks and impacts are summarized in Table 1.

Fire Related Feature	Health Impact	Population
Air pollution: fine particles	Burning eyes Runny Nose Bronchitis Aggravation of chronic lung disease Aggravation of heart disease	People with allergies People with Emphysema, COPD, asthma, other lung disease People with Coronary artery disease, Peripheral vascular disease, congestive heart failure Smokers People with diabetes Older people more susceptible Children more susceptible (WA Dept of Health, 2016) (Finlay, Moffat, Gazzard, Baker, & Murray, 2012) (Air Now, 2003)
Trauma	Injury Burns	Firefighters Evacuees
Heat Induced Illness	Heat exhaustion Heat Stroke Dehydration	Firefighters Evacuees
Psychological Effects	Anxiety Depression Exacerbation of underlying mental illness Hostility	All people impacted by fires Especially those with underlying mental illness
Emergency Preparedness	Lack of help with evacuation Lack of treatment for injury	Heavy fire season may strain infrastructure and services
Loss of Buildings, Homes	Loss of livelihood, access to shelter, food, water Long term disturbance	Remote areas at higher risk Wildland-urban-interface at higher risk

Table 1. Health Impacts Related to Forest Fires

Case in Point

The three months of June, July, and August, 2015 in Spokane, Washington, were the hottest and driest on record (Prager, 2015). By the end of summer, thousands of fires had burned across the nation, with the highest acreage burned ever recorded. 2015 brought the most acres of wild land burned since fires have been tracked, over 1.1 million acres (NIFC, 2015). Spokane, WA, an urban area with a population of almost half a million people, experienced weeks of poor air quality (Brunt, 2015). The EPA listed Spokane's air as the most polluted in the nation one Friday afternoon in August, and claimed it was the poorest air quality since Mount St. Helens volcano erupted in 1980 (Mann, 2015). Four deaths and 21 injuries were recorded among firefighters in Washington (Inslee, 2015). Many people lost their homes, and hundreds of thousands of people were exposed to significant air pollution for an extended period of time. The Spokane Regional Health District listed the air as "very hazardous" and warned people to stay indoors. Several public outdoor events were cancelled in an effort to reduce health impacts. By September, \$319 million had been spent fighting Washington state fires in 2015.

The impacts of a devastating fire season such as this are difficult to quantify. Loss of infrastructure from schools, roads, homes and public buildings destroyed by wildfires damage livelihood and community functioning. Loss of forests and agriculture lands cause untold economic losses. Injuries and fatalities from fighting fires are devastating to the families of those individuals. Increased burden of air quality and heat on vulnerable individuals and populations lead to both acute and chronic health challenges.



Figure 8. Forest fire. <http://www.fs.fed.us/outernet/pnw/research/fire/index.shtml>

The importance of preparation for intense fires cannot be overstated. Even though as a nation we enjoy a sophisticated wild land firefighting apparatus, the speed and intensity of modern fires taxes its capacity. Less developed is a prepared public health system, particularly to anticipate high intensity fires with the long-term presence of smoke, and to protect the public with warning systems, clean air spaces, air filtration, education, and access to care. Intense fires seasons have been called the new normal in the northwest and other states, and preparation for health impacts is an important element to address.

What Can Nurses Do?

Public health nurses are in ideal positions to influence policy, develop assessment tools, educate and deliver individual care. Nurse researchers have access to recent research findings and can use them to study ways to reduce the health impacts in vulnerable populations. Nursing faculty can teach students about the health impacts of forest fire smoke and the increased risk of fires with global warming. Nurses can be community leaders to bring solutions to their communities and regions. With the most trusted voice in the nation, nurses are effective spokespeople for common sense responses to this enormous challenge. A new resource is available on public health and wildfires that nurses can use in their work (See Resources).

Drought in the Southwest

The Southwest region of the United States is the hottest and driest region in the country. However, it is also comprised of an incredible diversity of landscapes such as mountains,

desert, coastal, canyons, and plains. This range of landscapes creates natural climate variability that makes the Southwest particularly susceptible to climate impacts.

The Southwest is already experiencing temperature increases due to climate change. The average temperature has increased by approximately 2° F over the past 100 years and the first decade of the 21st century was the warmest decade since records began in 1901 (EPA, 2016e). Heat-stress is the leading cause of weather-related death in the Southwest, and these numbers are expected to increase as the duration, intensity, and number of heat waves increase with climate change. The elderly and low-income residents who do not have air-conditioning are particularly susceptible to these effects.

The region is also heavily populated with over 56 million people living in the Southwest. This population is expected to grow by over 70% by 2050 (EPA, 2016e). Many of those living in the Southwest are concentrated in metropolitan areas where heat island effects are most prevalent. This makes the cities warmer than surrounding areas and increases residents' vulnerability to heat-related health impacts.

Many areas of the Southeast are already experiencing strains on their water supply and this is only expected to increase with climate change. Much of this region relies on snow-melt for a significant portion of their freshwater supplies. With warming temperatures, the amounts of snowfall and resultant snowmelt have been decreasing. Increasingly severe drought conditions are also expected by the end of the century (Cook, Ault, & Smerdon, 2015). Decreased water supplies and increased human need for water as the Southwest populations expands may tax an already strained water delivery system.

Case in Point

There are 182 federally-recognized tribes in the Southwest. Just as the Southwest is comprised of a wide range of different climates and landscapes, the areas where tribes are located are equally diverse. However, the majority of tribes will unfortunately be some of the most vulnerable populations to the impacts of climate change. This is due to their unique cultural practices and negative impacts on plants and animals used in traditional life-ways, high poverty rates in many tribal communities, lack of access to health services, water rights, and lack of political capital.

Many reservations are sited in areas that have extreme environmental conditions and where sustaining a minimum quality of life is already a challenge. In these types of environments, even small decreases in rainfall or temperature increases can have significant impacts. The Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment (2013), notes that interviews with tribal elders show the tribes already seeing impacts from climate change. Navajo elders report seeing declines in snowfall and water availability. They are also seeing “water sources disappearing and the plants and animals found near water sources or in high elevations, such as certain medicinal plants, cottonwood trees, beavers, and eagles.” They are also having more difficulties growing corn, a crop that is central to many Native cultural practices.

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What Can Nurses Do?

Addressing climate change in the Tribal communities presents a challenge due to limited resources as well as issues related to Tribal and federal and state government relations. Nurses can play a role in helping tribes highlight the links between climate change and the health of Tribal members. Nurses can also provide strong voices in advocating for resource allocations that can be used to support climate resilience among the tribes.

Stinging Insect Allergies in Alaska

Temperatures are rising more rapidly in the north, with Alaskans experiencing some of the most significant increases in temperature since 1970. Over the past 60 years, the average temperature across Alaska has increased by approximately 3°F, more than twice the warming seen in the rest of the United States. Warming in the winter has increased by an average of 6°F (Stewart et al, 2013) and has led to changes in ecosystems such as the distribution of insects, especially allergenic ones such as wasps, bees, and yellow jackets (Hymenoptera). Historically, harsh winters in Arctic regions make it difficult or impossible for wasps to overwinter (Wartinbee, 2013).

As the climate warms, less ground will experience freezing, increasing the opportunity for the insects to expand their territory. With the extended warm seasons, wasps are emerging earlier in the season and remaining longer, increasing the likelihood that residents will encounter them. The higher temperature also elevates their level of aggressiveness. Wasps are now found above the Arctic Circle (Wartinbee, 2013).

Research is emerging linking climate changes and allergic responses to stinging insects. Stinging insect allergy is responsible for more than 10% of all cases of anaphylaxis (EPA, 2016; Tankersley & Ledford, 2015)

Case in Point

In 2006, Fairbanks, AK, reported its first cases of fatal anaphylaxis as a result of Hymenoptera stings concurrent with an increase in insect reactions observed throughout the state. Concerned by the increase in anaphylaxis events and the deaths of healthy young men from insect stings, an immunologist decided to explore trends of patients seeking medical care for adverse reactions after insect-related events in Alaska (Demain & Gessner, 2008).

Data revealed a statistically significant trend in patients seeking care for insect reactions. Fairbanks Memorial Hospital Emergency Department reported a fourfold increase in patients in 2006 compared with previous years (1992-2005). The Allergy, Asthma, and Immunology Center of Alaska reported a threefold increase in patients from 1999 to 2002 to 2003 to 2007. In some areas of Alaska, reports of severe stings from Hymenoptera were increased by 600 percent within an eight-year time period. Increases in insect reactions in Alaska have occurred after increases in annual and winter temperatures, and findings from this landmark study indicate that they may be causally related (Demain & Gessner, 2008).

Severe insect-sting allergies are becoming more common in Alaska (Heddle & Golden, 2015), with clinics experiencing a surge in the need to care for patients sick enough to seek medical attention from stings when compared to just a decade ago (Anderson & Andrews, 2016; Costa, 2015; Demain, 2009).

More data collection is needed, with ongoing analysis to further understand the associations between stinging insect allergies and climate change. Educating families about avoiding stings and getting help soon after a sting is imperative to reduce the number of fatalities. The US



Figure 9: Local newspaper article discussing death from insect sting

Climate Resilience Toolkit offers resiliency resources entitled the Arctic Adaptation Exchange (USCRT, 2016) that provides opportunities to share adaptation strategies to climate changes that can be used by nurses to better understand health impacts.

What can Nurses Do?

Educating the public about methods for preventing stings is an important role for nurses, especially those working at schools, camps, primary care clinics, and public health settings.

Prevention of stings may include the following steps:

- Wear long sleeves and pants in colors less likely to attract insects (e.g., white, khaki)
- Avoid wearing flowered prints, colors
- Avoid wearing perfume
- Avoid walking barefoot
- Outdoor food should be stored in containers
- Avoid running from stinging insect
- Avoid swinging or swatting at an insect which may cause it to sting

Those at risk of anaphylaxis should consider carrying epi-pens and wear a medic alert bracelet. Nurses should also consider collecting surveillance data on insect stings and outcomes if not already collected. This information can be linked with climate changes to determine if changes are impacting the incidence of sting related health impacts.

U.S. Pacific Islands: Decreasing Freshwater Availability in Hawai‘i

Climate change is expected to affect the availability of freshwater, particularly in the US Pacific Islands. Overall, Hawaii’s average precipitation has decreased in the last century, with a reduction in the flow of streams and rivers, reducing freshwater availability and impacting both supplies of drinking water and irrigation water for crops. Also, increasing temperatures that have been experienced on the islands with global warming are expected to increase the likelihood of drought (EPA, 2016a; Leong, et.al, 2014; Karl, Melillo, & Peterson, 2009).

Exacerbating concerns over freshwater resources is the intrusion of saltwater from the ocean into freshwater supplies from storms and as sea levels rise. Finally, impacts on freshwater supplies will be especially critical in areas experiencing population growth or where infrastructure is old or poorly maintained (EPA, 2016a; Leong, et.al, 2014; Karl, Melillo, & Peterson, 2009).



Figure 10: Hawai‘i coastline

Case in Point

Hawai'i has been forced to address ongoing drought conditions with an increasing trend in the length of dry periods, especially from 1980-2011 (Chu et al., 2010). In 2008, every county in Hawai'i was designated a natural disaster area as a result of drought conditions. As part of the climate changes seen in the state, drought has created concerns over supplies of freshwater for drinking and agriculture, with a negative impact on public health (Stewart, 2013). Efforts are underway to help farmers, ranchers, and their communities prepare a drought plan since drought is part of the natural climate cycle and will increase. In addition, there is a need to identify strategies for assisting agricultural communities to access health services to meet physical and mental health needs that supports self-reliance and independence (Finucane & Peterson, 2010; Stewart, 2013).

What Can Nurses Do?

In response to climate changes experienced by the state, agencies in Hawai'i have drafted a framework for a coordinated statewide climate adaptation plan (Hawaii Department of Health, 2016). The Hawai'i Climate Change and Health Working Group, co-chaired by Nancy Partika RN MPH, was assembled and convened in 2015 to help the State consider and plan for impacts from climate change on population-based health issues and to address climate change adaptation. One key goal is to obtain climate change-dedicated resources for the Department of Health, so that it can address ongoing planning and development of climate change and public health issues.

Working Group recommendations include the need for improved baseline health and surveillance data to determine climate-related health impacts, and to provide skills to the public health workforce to better respond to public health needs as a result of climate changes (Partika, 2016). For more information about the range of climate changes and impacts on health in Hawai'i, watch an interview with Nancy Partika RN MPH (see Resources.)

Nurses' Professional Obligation

Nurses are the largest health profession not only in our nation, but in the world (WHO, 2016). Nurses are the most trusted voice in the United States for many years running (Gallup, 2015). American nurses are called by their professional standards to address environmental health risks, including climate change (ANA, 2015). Nurses are in key positions to impact change in their varied roles. Using the REAP Model of the Alliance of Nurses for Healthy Environments (ANHE), the broad categories of Research, Education, Advocacy, and Practice are addressed.

Research

Nurses contribute to scientific findings by researching climate related topics and health issues. For example, nurses have contributed to the literature through epidemiological studies, educational frameworks, policy statements, and practice initiatives (Anderko, Davies-Cole, Strunk, 2014; Barna, Goodman & Mortimer, 2012; McDermott-Levy, Leffers, & Huffling, 2014; Polivka, Chaudry, & Mac Crawford, 2012).

The recent Climate and Health Assessment (Bell et al., 2016; Dodgen et al., 2016; Sarofim et al., 2016) outlines detailed research recommendations that nurses should consider. These recommendations address climate changes and health impacts (including mental health), evaluation of adaptive interventions to reduce adverse health outcomes, how social determinants contribute to vulnerability to health impacts and mapping these vulnerabilities, impacts on food safety and availability and evaluation of how climatic variables, socioeconomic

factors, and human behavior influence disease occurrence and are expected to affect human adaptive capacity and the ability to respond to future disease threats.

Education

Nurses educate patients and professionals, and have opportunities to include evidence and information about climate change in Colleges of Nursing, in continuing education for nurses, in patient education materials, and in efforts to educate the public.

- ANHE’s Environmental e-text covers many topics related to environment and health, including climate change. It can be viewed here: <http://envirn.org/pg/groups/38377/etextbook-table-of-contents/>
- Educators can access resources related to climate change and health to include in course curricula and professional talks
- Faculty members can advocate for inclusion of information about climate change in all nursing curricula, and on nursing licensing exams.
- Nurses can educate patients and families about health issues associated with climate change, such as asthma, heat stroke, wildfire respiratory reactions and others
- ANHE will host a conference on Climate Change, Health and Nursing in June, 2017
- *Reproductive Health and Climate Change*, CDC, Pediatric Environmental Health Specialty Units Network (1 CE) <http://www.pehsu.net/webinars.html>
- US Climate Action Network Video and Workbook (3 CEs) - Advancing Clean Air, Climate, & Health: Opportunities for Nurses <http://envirn.org/pg/pages/view/82102/advancing-clean-air-climate-amp-health-opportunities-for-nurses>
- *What Health Professionals Can Do About Climate Change* is a recently created brochure by ANHE and Moms Clean Air Force for health professionals that outlines steps for advocating for clean air and family’s health: <http://www.momscleanairforce.org/health-professionals-climate-change/>

Advocacy

Nurses are influential in policy decisions, through advocacy and by encouraging policy makers to support climate healthy decisions. It is critical that nurses educate policy makers on the need for strong action on climate change due to health impacts. The Alliance of Nurses for Healthy Environments developed a statement on *Nursing and Climate Change* to encourage nursing organizations to create climate and health policy statements for their organizations (<http://envirn.org/pg/blog/read/86807/anhe-white-house-climate-and-health-roundtable>):

ANHE’s Advocacy Statement on Nursing and Climate Change

Nurses are on the front lines in caring for America’s health. Nurses recognize that climate change is threatening life as we know it. In light of the current and predicted health threats from climate change, nurses are committed to investing in the necessary knowledge and skills to address the health needs of the American public, to engage in mitigation activities in our personal and professional lives, to participate in climate change-related disaster responses, and

to support and engage in policy discussions to insure equitable care for all Americans in the face of climate impacts.

Climate change is causing extended heat spells; both flooding and droughts across the country; extreme weather events; larger and hotter forest fires, and threatened food crops. There are a wide range of human health and safety and mental health threats that are posed by climate change's impacts. Nurses will help to lead the health charge in preparing for these conditions.

Nurses are the most trusted sources of information to the American public and we are in every community. We are in hospitals, clinics, schools, workplaces, nursing homes and people's homes. We will take leadership in helping our patients, our communities, and our health care institutions to engage in climate change mitigation activities and in preparing for potential effects of climate change.

We Commit to the Following:

- To educate ourselves about climate change and staying up to date
- To make changes in our personal lives to reduce our carbon footprint.
- To educate our patients and their families and the communities we serve about climate change, the associated health effects, and ways in which to both mitigate and respond to climate change.
- To work in our communities to be best prepared for climate change-related emergencies.
- To work within our nursing organizations to help prioritize climate change and its impacts as a nursing issue.
- To work within nursing schools, at colleges and universities, to ensure that climate change, including mitigation and response, is a required component of nursing curriculum.
- To raise our voices within our communities and through our nursing organizations in policy arenas at the local, state, and national level to advocate for policies that will mitigate the current trajectory of global warming.
- To engage in policies and practices that will address equitable distribution of resources for those who are affected by climate change impacts.
- To develop research agendas that address climate change's impacts and nursing interventions
- To work collaboratively with each other in order to bring our best and finest nursing knowledge and skills to mitigate and address the threats from climate change.

Practice

Nurses deliver direct care to people of all ages. Care in the setting of climate change includes understanding health impacts and treating individuals and families for health issues that arise, as well as preventing further climate change through mitigation efforts. For instance, nurses are called by their professional standards to practice in “an environmentally safe and healthy manner”, thus to reduce the climate impacts of their own practice. Nurses practice in many different settings, including acute care, clinics, homes, community centers, schools, universities,

businesses, government agencies, armed forces, and more. In each of these, nurses can work to reduce climate impacts through several key avenues.

- Ask practice sites to reduce use of fossil fuels by encouraging energy efficiency and use of renewable, non-polluting energy sources.
- Encourage staff to commute to work in less carbon intensive ways than driving single occupancy vehicles. Help workplaces establish incentive programs to encourage this.
- Get involved in the decision-making process for purchasing equipment and supplies. The production, transportation and disposal of healthcare goods is very climate intensive. Nurses with knowledge about polluting characteristics can help practice sites make better choices.
- Help establish healthy food systems at practice sites such as hospitals and schools. Not only does this improve the health of the workforce, it created less carbon pollution, antibiotic overuse and pesticide use.

Nurses Leading the Way

Nurses have been in the forefront of facing the challenges of climate change and advocating for actions that will reduce health impacts at the individual and societal levels. There are several examples of nurses leading the way.

In 2013, the White House Champion of Change award for Climate Change and Public Health was awarded to two exceptional nurses for their work:

Laura Anderko PhD RN

www.whitehouse.gov/blog/2013/07/17/changing-lens-communicating-public-health-issues and

Therese Smith, RN BSN MPA

CCM www.whitehouse.gov/blog/2013/07/17/protecting-human-health-changing-climate.

Charlotte Wallace, RN, MS was invited to join President Obama as he outlined climate changes and public health impacts, discussing the role of health professionals in supporting healthy public policy: <https://www.whitehouse.gov/photos-and-video/video/2015/04/07/president-speaks-impacts-climate-change-public-health>

Patricia Butterfield, PhD RN participated on a panel at a White House Summit on Climate Change and Health, discussing the role of climate change in curriculum and best practices in



Figure 11. White House Champions for Change Therese Smith, RN (3rd from left) and Laura Anderko PhD RN (5th from left)

the field. <https://news.wsu.edu/2015/06/29/nursing-prof-a-white-house-climate-change-panelist/>

Katie Huffling, MS, RN CNM orchestrated the first White House event dedicated to nurses responding to climate change and health impacts. The summit brought together nurse leaders from national organizations to learn about health impacts and craft a response from the nursing profession on how best to address these needs. <http://envirn.org/pg/blog/read/86807/anhe-white-house-climate-and-health-roundtable>



Figure 12. Climate Change Roundtable at Howard University. From Left to right at top: Surgeon General Dr. Vivek Murthy, President Barak Obama, Charlotte Wallace, EPA Administrator Gina McCarthy

Nurses Voices from across the Nation: Personal Stories

Nurses across the nation see the impacts of climate change on health, and many are committed to addressing the challenge of global climate change. We have collected these stories on our websites and hope that you will find them inspiring. We welcome nurses from all backgrounds to share their climate stories with us. To submit your story please contact Katie Huffling at katie@envirn.org. Below are just a few of the stories you'll find at www.enviRN.org.

Laura Anderko PhD RN

Al Gore's landmark film, *An Inconvenient Truth* in 2006 started me on my journey to become more involved with addressing climate change and health impacts. Activities have included the development of a course in climate change and health, conducting research on the health impacts from heat waves, and advocating for clean, renewable energy. In 2013, the White House honored me as a Champion of Change for my advocacy work in addressing Climate Changes and Public Health.

Stephanie Chalupka EdD, RN, PHCNS-BC, FAOHN, FNAP

A growing understanding of the impact of climate change on children's health, and the impact of climate change on the health care delivery system brought me to my work with climate change. I have focused my efforts to address climate change in two areas, the education of health professionals about the impact of climate change on human health, as well as assisting hospitals to enhance resilience for a changing climate and improve their response to extreme weather events.

Phyllis Eide PhD, MPH, APRN-BC

I've been an RN since 1978, in academia since 1992, and involved with climate change issues since 2009, when I did a certificate on "Decision Making for Climate Change" through the

University of Washington. Since 2010, I've done numerous presentations and posters at regional and international conferences on climate change's impact on human health, and initiated a climate change writing group with 3 nursing colleagues (2 manuscripts in preparation, 1 in circulation). I'm currently analyzing pilot data from a small study of nursing faculty on attitudes related to climate change.

Robyn Gilden PhD RN

As a faculty member at the University of Maryland I am developing an online course in climate change and health, as well as heading up a Climate Change and Health Workgroup for the School of Nursing. In 2016, I had the opportunity to attend the White House event when the U.S. Global Change Research Program (USGCRP) launched the Climate and Health Assessment (video on folder)

Sally Melcher-McKeagney RN-BC

I live in Fairfield, Maine, and work as a staff nurse in an inpatient psychiatric unit. My voice seems strongest when I discuss the effects of climate change on human health.

Beth Schenk, PhD, MHI, RN-BC

My area of research focus is the environmental impacts of healthcare. I developed the Nurses Environmental Awareness Tool (NEAT), to help ascertain nurses' awareness of the environmental impacts of healthcare, and the mitigating behaviors they perform. I live and work in Missoula, Montana. Video in folder

Lois Wessel, RN, CFNP

I work at the Mid-Atlantic Center for Children's Health and the Environment at Georgetown University. I am passionate about connecting my patients, mostly low income Latinos, to the outdoors for physical and mental health purposes.

Conclusion

As nurses, we need to consider next steps to reduce greenhouse gases to mitigate climate change, and to prepare for the changes already occurring. How will we know we are successful? First, a majority of nurses in the United States will be aware of the health impacts of climate change and what nurses can do about it. This will be accomplished through colleges of nursing, standards for nursing education and questions on the registered nurse licensing exam (NCLEX). Second, nurses will reduce the climate impacts of their practice in settings ranging from hospitals to neighborhoods. Reducing impacts include decreasing greenhouse gas production through increasing renewable energy use and encouraging consumption of locally grown, plant-based dietary options for families. In addition, nurses must become involved in developing community adaptation plans that will ensure safety and preparedness for the effects of extreme weather events. Third, nurse researchers will contribute to understanding the human response to climate change, including illness, quality of life, effective interventions, and more. Nurses are in unique positions to explore the success of adaptation plans to reduce health impacts from climate changes. These actions must be supported through improved funding. Finally, nurses must advocate for change within their workplaces and at all levels of government for healthy public policy including renewable energy options.

Nurses' voices, through writings and media will increase awareness of climate changes impacts and inspire common sense responses to this tremendous challenge. As the nation's largest body of healthcare professionals, and as the nation's most trusted professionals, nurses can

make significant changes to improve society's response to climate changes and drive the changes needed for a healthy future.

Resources

1. **Climate and health assessment-** <https://health2016.globalchange.gov>
2. **IPCC Report** - <http://www.ipcc.ch/report/ar5/wg2/>
3. **Climate change and role of health professional** - <https://www.chausa.org/docs/default-source/general-files/climateandhealth.pdf?sfvrsn=6>
4. **US Climate Resilience Toolkit** - <https://toolkit.climate.gov/topics/human-health>
5. **Healthy hospitals, healthy planet** - https://noharm-global.org/sites/default/files/documents-files/1217/Healthy_Hosp_Planet_Peop.pdf
6. **ANHE Nursing Leaders Letter. May, 2016.** <http://envirn.org/pg/blog/read/86807/anhe-white-house-climate-and-health-roundtable>
7. **National Oceanic and Atmospheric Administration (NOAA) Community Resilience toolkits:** <https://toolkit.climate.gov/tool/extreme-heat-media-resources-toolkit>.
8. **Air Quality Information, including wildfires:** https://www.airnow.gov/index.cfm?action=topics.smoke_events
9. **Vital Signs of the Planet: Educators** <http://climate.nasa.gov/resources/education/>
10. **Nurse.com On-line Learning** <https://www.nurse.com/blog/2015/10/12/44479/>
11. **International Council of Nurses Statement:** http://www.icn.ch/images/stories/documents/publications/position_statements/E08_Nurses_Climate_Change_Health.pdf
12. **World Health Organization:** <http://www.who.int/mediacentre/factsheets/fs266/en/>
13. **Environmental Protection Agency:** <https://www.epa.gov/climate-impacts/climate-impacts-human-health>
14. **CAMEL Climate Change Education:** <http://camelclimatechange.org/index.html>

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