



Climate Change and Health:

IS THERE A ROLE FOR THE HEALTH CARE SECTOR?

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On climate change,

IT IS NOW TIME TO ACT,

with clear purpose, creativity, care and compassion,

especially for our sisters and brothers who will

suffer the most from past neglect and, if we turn

our back, our future indifference.

JOHN L. CARR, EXECUTIVE DIRECTOR,
UNITED STATES CONFERENCE OF CATHOLIC BISHOPS:
JUSTICE, PEACE AND HUMAN DEVELOPMENT

INTRODUCTION

OVERVIEW

Pope Benedict XVI and the U.S. Catholic Bishops accept the scientific consensus that climate change is upon us and urge prudent action now to more faithfully care for creation and to avoid more severe consequences in the future, and they warn that its adverse impacts will fall heaviest on the poor at home and abroad.

As Catholic health care providers, climate change is a moral concern and our faith demands prudent action to reduce our carbon footprint, protect human life and dignity, care for “the least of these” (*Mt. 25*) and raise our voice on behalf of creation and the poor. Our belief that all life is sacred and that our special concern for the poor and our commitment to the common good and stewardship call us to examine this issue and to act to lessen and treat the effects of climate change. Specifically, the escalating problem of climate change is an issue for Catholic health care because:

- + We are people of faith and believe “the earth is the Lord’s and all it holds.” (*Ps. 24:1*)
- + We understand there is substantial body of scientific knowledge showing “warming of the climate is unequivocal.” (*Intergovernmental Panel on Climate Change, 2007*)
- + As health providers, we are committed to the protection of human life and dignity. In this light, we are concerned that “many diseases will surge as the atmosphere heats up,” (*Scientific American, August 2000*) and that burden of caring for people will be born, in part, by the Catholic health ministry.
- + We can help reduce our own carbon footprint because “as one of the largest users of energy, hospitals are major contributors to climate change.” (*Global Health and Safety Initiative, 2008*)
- + We can help reduce our own carbon footprint because “hospitals and health care facilities are the second most energy intensive building sector in the U.S. [after retail food services], consuming in excess of eight percent of U.S. annual energy consumption.” (*U.S. Department of Energy*)

Health care providers can help address the problem of climate change and its impacts on the health and welfare of people worldwide, especially the most vulnerable by:

- + Reducing our contribution to the problem by decreasing energy usage, reducing emissions and waste and rethinking food service such as serving less meat and buying locally to reduce long-distance food distribution.
- + Caring for those who are victims, being vigilant to the effects of extreme temperatures especially for the very old and young, focusing on respiratory and other health problems that are accelerated by climate change.
- + Advocating for public policies and private actions that will bring solutions.

CHA, funded through a grant by the Catholic Coalition on Climate Change and the National Religious Partnership for the Environment, and in collaboration with Health Care Without Harm (HCWH), offers this article, *Climate Change and Health: Is There a Role for the Health Care Sector?*, as a tool for continuing discussions and information sharing about climate change.

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Climate Change & Health:

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OVERVIEW

Our world is changing. Human activities are causing environmental changes of epidemic proportions. Climate change, experienced as 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, highlight the critical need for us to consider the consequences of these environmental changes on health. The earth's temperature is increasing, mainly as a result of human activity such as burning fossil fuel and greenhouse gas emissions from energy production, transportation, industry 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), yet little attention has been focused on the potentially catastrophic health effects of climate change.

Scientific evidence strongly suggests that climate change is contributing to disease and premature deaths worldwide.

Health impacts can result from direct exposures to climate change through changing weather patterns (e.g., heat waves) and extreme weather events, or indirectly through changes in water availability, air quality and resultant changes in agriculture and the economy (Knowlton *et al.*, 2011). There are endless examples of the negative health effects of extreme climate events and health. Droughts and floods have disrupted growing seasons resulting in crop failures which can lead to an increase in malnutrition and related disorders, particularly as it relates to child growth and development such as low birthweight (Portier & Tart, 2010). Water availability has been impacted by changes in precipitation due to alterations in the rainy and dry seasons, and air quality will continue to worsen as increases in ozone pollution are experienced, due to temperature increases and air stagnation (Costello, 2009; Denman *et al.*, 2007). There has also been a steady increase in certain vector-borne diseases, such as malaria. Due to higher temperature, mosquitoes reproduce more rapidly under these conditions (Meehl *et al.*, 2007). Mental health conditions such as anxiety and depression may result (Costello *et al.*, 2009) from extreme weather events. Extreme weather events have the potential to cause particular devastation and health effects in poor and less-developed countries through crop loss, increased respiratory and diarrheal diseases and population displacement (St. Louis & Hess, 2008). In recent years, more than two billion people worldwide have been directly impacted by natural disasters related to weather phenomena including floods, droughts, heat waves and extreme cold (Costello *et al.*, 2009).

Regional climate changes are on the rise. In the Northeast, extreme precipitation events are becoming increasingly common, while in the Southwest, droughts are more frequently experienced (Portier & Tart, 2010). These effects will continue to increase with climate changes.

Populations at Greatest Risk

Populations who are at greatest risk and considered most vulnerable to the adverse effects of climate change lack the ability to cope with the consequences of climate change.

Children, pregnant women, older adults and the poor are typically more susceptible to illness associated with heat and extreme weather events, as well as waterborne, vector-borne and food-borne illnesses.

There are a number of considerations used to evaluate vulnerability to the health effects of climate change, including geographic factors (*urban centers that have higher levels of air pollution*) and demographic factors (*children, elderly, low socioeconomic status*). However, the effects of climate change on the health of a given community depend not only on exposures and demographics, but also on how these characteristics intersect. For example, the interaction of urban area exposures (*heat waves*) in vulnerable populations (*poor*) and those living without air conditioning can result in catastrophic effects (*Ebi et al., 2008*). Table 1 summarizes weather events, health effects and populations most affected as presented by the Centers for Disease Control (<http://www.cdc.gov/climatechange/policy.htm>).

Children

Prenatal or childhood exposure to infectious diseases, toxicants, infectious agents or conditions such as malnutrition cause potentially life-long effects (*Ebi & Paulson, 2007; Sheffield & Landrigan, 2011*). The immature immune system of children places them at high-risk for serious consequences of food and water-borne diseases. Children spend

more time than adults outdoors, breathe more rapidly than adults and are still developing their respiratory structures. There is strong evidence of associations between respiratory disease and a wide range of environmental variables impacted by climate. Additionally, children are less able to deal with heat and are more susceptible to dehydration. They are therefore, more vulnerable to heat-related disease and death and will suffer disproportionately as the Earth warms (*Ebi & Paulson, 2007; Sheffield, & Landrigan, 2011*).



Older Adults

Older adults have less ability to regulate body temperature and adapt physiologically to extremes in temperature. In fact, advanced age is one of the most significant risk factors for heat-related death in the U.S. (*Physicians for Social Responsibility (PSR), n.d.*). In addition, older adults often have pre-existing medical conditions that are made worse by climate-related conditions (*Balbus & Malina, 2009*). For example, as the temperature increases, the incidence rates for stroke or cardiovascular hospital admission rise. Finally, older adults are also more likely to live alone, have limited mobility, cognitive constraints and have reduced social contacts, all factors that further increase their vulnerability.

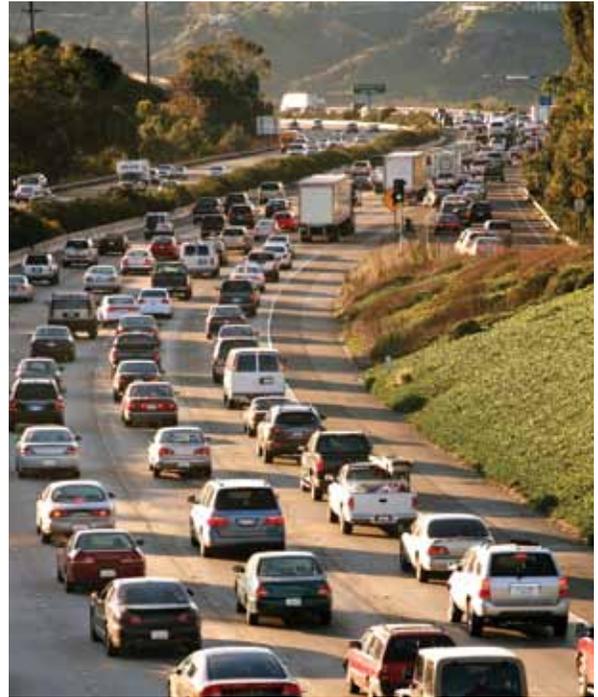
Poverty

Those living in poverty are also extremely vulnerable to many of the health effects of climate change. Existing illnesses and challenges in daily life are further complicated by disruptions in access to public services, displacement from homes and the need to migrate with limited transportation options, and increased stress as a result of extreme climate events.

Worldwide, adverse health impacts will be greatest in low-income countries and will also include in addition to children, elderly and the poor, at-risk groups such as subsistence farmers and coastal populations (*Knowlton et al., 2011; Parry et al., 2007*). The United Nation Intergovernmental Panel on Climate Change (*IPPC*) predicts that global climate change will result in increases in malnutrition, death, disease and injury from heat waves, floods, storms, fire, drought and expand the geographic range of malaria in the poor countries of the world (*Parry et al., 2007*). The health effects of global environmental change will vary between countries. Loss of healthy-life years attributable to climate change in low-income African countries, for example, is predicted to be 500 times that of Europe (*McMichael et al., 2008a*). Ironically, the world's poor, who are low consumers of energy and least responsible for climate change, are the most impacted by drought, floods and other extreme weather events that have forced whole communities and populations to migrate from their homeland (*The Catholic Health Association, 2009*).

HEALTH IMPACTS

Climate change has been characterized as "... the biggest global health threat of the 21st century," (*Costello et al., 2009, p. 1659*) and is already negatively impacting human health that will multiply dramatically if no action is taken.



Heat-Related Illnesses

Average global temperatures are rising and are expected to continue to increase for decades after greenhouse gas emissions are reduced due to a significant lag in the cooling of the oceans. As a consequence of the increasing frequency of extreme heat events, it is projected that global average temperatures will rise between 1.8 and 4.0°C by the end of the 21st century. People will suffer the health consequences of this global temperature rise by experiencing increasing rates of heat stress and exhaustion, heat cramps, heat stroke and death (*Portier & Tart, 2010*).

In 2003, heat waves in Europe resulted in almost 70,000 deaths, largely from cardiovascular and respiratory events (*Costello et al., 2009*). It is expected that summer temperatures in Europe as high as those experienced in 2003 will become the norm by the middle of the 21st century (*World Health Organization [WHO], 2009*). In the U.S., extreme heat events already cause more deaths annually than all other extreme weather events

combined, on average causing 688 heat-related deaths annually (Portier & Tart, 2010). 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 (Kovats & Hajat, 2008). Much of the excess mortality from heat waves is concentrated in infants, children and those over 65 (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.

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” affect 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).

Poor Birth Outcomes

Over the last decade, a large number of studies have investigated the adverse effects of climate change, specifically air pollution and/or heat on birth outcomes (Balbus & Malina, 2009). Evidence supports a strong causal relationship between air pollution and respiratory deaths in the post-neonatal period (Radim et al., 2005). A study analyzing almost 60,000 births in California found that increased temperatures were significantly associated with pre-term birth for all mothers, regardless of maternal racial/ethnic group, maternal age, maternal education or sex of the infant. An 8.6-percent increase in preterm delivery was associated with a 10°F increase

in the weekly average temperature, with greater risks observed for younger mothers, Blacks, and Asians (Basu et al., 2010). As temperatures continue to increase in some regions of the world, consideration of its impact on birth outcomes is critical.

Malnutrition and Food Security

Climate change also threatens human health through its impact on food insecurity and malnutrition by compromising agricultural production in areas with little adaptive capacity (Muller et al., 2011; Burke & Lobell, 2010). Malnutrition already exerts a significant burden on the world’s poor, contributing to as much as 11 percent of the total global burden of disease and 35 percent of excess child mortality (Black et al., 2008), but climate change is predicted to worsen malnutrition in the developing world (Parry et al., 2007; WHO, 2008). Extreme weather events and changes in temperature and precipitation patterns can directly damage or destroy crops and other food supplies, as well as interrupt the transport and distribution of food. This may happen seasonally, but is anticipated to become a chronic problem under changing climate conditions (Portier & Tart, 2010).

In some temperate climates, climate change could actually increase agricultural production. But in areas with little rainfall, local warming of as little as one degree could dramatically decrease the production of principal crops. Modeling studies have shown that corn and soybean yields in the USA fell by 17 percent for every degree rise in growing season temperature (Lobel & Asner, 2003).

It is predicted that by the end of the 21st century one half of the world’s population could face severe food shortages due to the impact of rising temperatures on staple food crops.

In subtropical and tropical regions, staple food crops could fall by 20-40 percent (*Battisti & Naylor, 2009*).



WATER QUALITY, SCARCITY AND DISEASE

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*). Changes in the frequency and severity of precipitation, rises in water temperature and altered coastal ecosystems could result in increased human exposure to harmful disease-causing organisms and toxic chemicals. In fact, the melting of summer ice caps, changing temperatures and rainfall and snow patterns will alter the availability and quality of water across much of the planet over the next 30 years; effects that are already evident (*Portier & Tart, 2010*). More than two billion people live in “dry regions” of the world and suffer disproportionately from infant mortality, malnutrition and other diseases related to contaminated or insufficient water (*Parry et al., 2007*). The projected scarcity of clean water is anticipated to dramatically increase diarrheal illness, which is already a leading cause of death in the developing world. Water scarcity and ecosystem

changes, which will decrease agricultural, livestock and fishing production, are anticipated to result in food shortages and famine (*Wiley & Gostin, 2009*). Africa is expected to experience severe water stress as early as 2020 (*Bates et al., 2008*). Here in the United States, water security is also becoming a pressing issue. In recent years, Southern states’ droughts have become a more frequent occurrence and Western states have experienced water shortages worsened by reduced mountain snow pack attributable to global warming (*Portier & Tart, 2010*).

VECTOR-BORNE DISEASES

Extreme weather events and climatic variations profoundly impact patterns of infectious disease. Temperature shifts will encourage the spread of infectious diseases. 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*). There is great concern that climate change will make certain environments more hospitable for some infectious diseases, thereby reintroducing some diseases into areas where they had been previously eradicated, worsening their already significant global burden (*Portier & Tart, 2010*). As environmental conditions change, the geographic range of the vectors for illnesses is extended, increasing the potential for infection.

One example, malaria, is strongly influenced by environmental temperature (*Paaijmans et al., 2010*). Malaria currently accounts for more than 80 percent of the climate-related disease burden in Africa (*Brilliant, 2007*) with 247 million cases and 900,000 malaria-related deaths globally (*WHO, 2009; Portier & Tart, 2010*). In 2005, it was estimated that three billion people (*45 percent of the world’s population*) lived in a malaria transmission zone (*Guerra et al., 2006*).

With as little as a two degree change in temperature, an additional one billion people will be living in the malaria transmission zone.

This means that 60 percent of the world's population will live in a malaria transmission zone.

RESPIRATORY DISEASES

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*). There is now strong evidence linking changes in the seasonal pattern of allergenic pollen and excess death from heat waves. 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. Temperature increases and increased carbon dioxide (CO₂) concentrations produce earlier flower blooming, affecting the timing and distribution of allergens such as pollen. More frequent precipitation and extreme weather events promote mold growth (*Portier & Tart, 2010*). 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*).

Allergic respiratory diseases and bronchial asthma is increasing worldwide, with people living in urban areas more frequently affected than those living in rural areas. Higher traffic volume in urban areas result in higher emissions results in poorer air quality, which is exacerbated with increasing temperatures. In a recent study conducted in the District of Columbia, significant associations were found between ozone concentrations and asthma-related emergency

department (ED) visits, especially for five to 12 year olds. Increases in the risk of asthma-related ED visits for children living in higher poverty zip codes versus other zip codes were also observed (*Babin et al., 2007*).



PREMATURE DEATH

Even small changes in temperature (*a degree or two*), coincide with increasing ground-level ozone, and are associated with premature death. Even a small increase in the ozone level has significant effects on death rates, with one study estimating that 3,700 deaths annually could be attributed to small increases in ozone levels (*Bell et al., 2004; Bell et al., 2008; Perera & Sanford, 2011*). Predictions indicate that health impacts from climate change and ozone pollution in 2020 will result in significant increases in acute respiratory symptoms, asthma-related ED visits, weather-related hospital admissions for infants and the elderly, lost school days and premature deaths (*Costello et al., 2011*).

PSYCHOLOGICAL IMPACTS

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 will become common as global temperatures rise, may be associated with a general increase in aggressive behavior, higher rates of criminal activity and increased suicide rates (*Berry et al., 2010*). Preliminary evidence suggests that suicide may increase above a certain temperature threshold leading researchers to theorize that hot weather may actually trigger psychological mechanisms like aggression and impulsivity (*Page, Hajat & Kovats, 2007; Qi, Tong & Hu, 2009*).

Climate change has the potential for significant negative impact on global mental health.

In natural disasters, the needs of those with chronic mental illness can be eclipsed by the need to provide trauma-focused psychological interventions. However, substance abuse and pre-existing respiratory and cardiovascular disease, which are highly common among people with serious mental illness, present particular risk. In addition, psychotropic medications are themselves a risk factor for heat-related death (*Page & Howard, 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. The long-term effects of climate change may displace 200 million people worldwide by 2050. Many of those displaced persons will already be vulnerable members of society existing at the margins (*Portier & Tart, 2010*).

THE REAL COSTS OF CLIMATE CHANGE

The human costs of climate change are just beginning to be understood. In 2000, the World Health Organization reported that since the 1970s, climate change contributed to approximately 150,000 deaths per year (*and did not consider all causes*). The global economic value of loss of life due to climate change has been estimated between \$6 billion and \$88 billion (*1990 US dollar prices*) (*Fankhauser et al., 1997; Fankhauser and Tol, 1997; Tol, 1995, 1996, 2002a, 2002b*) and are predicted to be substantially higher in low-income countries (*Viscusi and Aldy, 2003*).

Health care costs associated with ozone pollution and poor air quality as a result of climate change have been estimated for the U.S. to be approximately \$2.7 billion to \$5.4 billion (*2008 U.S. dollars*) for small increases in ozone levels (*1 ppb, and 2 ppb respectively*) (*Perera & Sanford, 2011*). Health care costs for treating childhood asthma is now \$2.2 billion (*2008 U.S. dollars*) annually and reflects a significant increase since last reported in 1997 (*Trasande & Liu, 2011*). If current regulations were changed to reduce air pollution 7 percent below the current standard, the U.S. would save an estimated \$15 million a year in health care costs (*Sheffield & Landrigan 2011*).

THE HEALTH CARE COMMUNITY: OPPORTUNITIES FOR ACTION

Climate change will cause profound challenges for humanity in the coming decades, which will necessitate a significant response from the health care sector. Health care providers and health care facilities will be on the front line in dealing with the impacts of climate change. It is essential that the health sector participate in placing human health issues at the center of the climate discussions. According to Dr. Margaret Chan, director general of the World Health Organization (WHO) (*2007*), “We have compelling reasons for doing so. Climate change will affect, in profoundly adverse ways, some of the most fundamental determinants of health: food, air, water.”



Health Care Providers

Health care providers have been challenged to become agents of change in their areas of influence so that the health of populations and the integrity of their environments will be ensured for future generations (Schwartz, 2006). Health care professionals may not fully appreciate how state and national climate policy has direct relevance to health, or how important their voice matters. Sheri Torjman of the Caledon Institute of Social Policy explains, “We literally eat, drink and breathe public policy. Public policy determines the quality of the air we breathe and the water we drink. It affects the food we eat – how it is harvested, where it is distributed and sold, and how much we pay. It controls the way in which we clean and monitor the safety of the water supply” (Torjman, 2005, p.1). As trusted conveyors of health information for patients, community members, and policy makers, physicians and nurses have a role and some might say a moral and professional responsibility to act. Health professional organizations including the American Nurses Association, the American Medical Association and the American Public Health Association have taken a stand on climate, health and the role of physicians and nurses through resolutions introduced (See Figures 1, 2).

AMERICAN PUBLIC HEALTH ASSOCIATION
Policy # 20078: Addressing the Urgent Threat of Global Climate Change to Public Health and the Environment.

“The public health community should advocate for mitigation and avoidance of climate change, track the impacts of climate change on human health and assist with adaptation, to the degree possible, to those health effects caused by changes in climate that can not be prevented.”

APHA, 2007

Health care professionals must first become informed about the health implications of climate change in order to educate clients and communities.

The Climate and Health Literacy Consortium (HCWH a, n.d.) is a collaboration of the leading organizations working to educate the public, health care professionals and facility administrators about the health effects of climate change, and how climate change policy and consumption choices influence the health of our communities. A list of key resources can be found on Health Care Without Harm’s

website at www.noharm.org/us_canada/issues/climate/chlc/. Other resources available to health professionals include, *The Adaptation Clearinghouse* developed by Georgetown Climate Center (www.georgetownclimate.org/adaptation/clearinghouse) and the materials available through the Catholic Health Association (www.chausa.org/Climate_Change).

Health care professionals can lead by example by reducing their personal carbon footprints and embracing sustainable lifestyles (e.g., a reduced dependency on automobile travel) and to consider the environmental costs at work (e.g., purchasing for your facility) (*American Academy of Pediatrics (AAP), 2007*). Health professionals can also play a vital role in local and regional climate adaptation strategies by preparing their patients, health care facilities and communities to be resilient and best cope with the anticipated health impacts of climate change (*Gould, 2011; McMichael et al., 2008 b*).

Health Care Industry

The health care industry also has a critical role to play in preventing climate change. Hospitals use about twice as much total energy per square foot as traditional office space (*Department of Energy, 2008*).

Energy efficient hospitals can save money, help prevent greenhouse gas emissions, improve the air quality of their communities and support their commitment to public health.

Incorporating green building and smart landscaping into hospital design reduces energy use and greenhouse gas (GHG) emissions. Proper site locations can help contain urban sprawl and lessen auto dependence. Health care facilities also

use substantial amounts of water and can play an important role in mitigating the problem of climate-induced water scarcity by implementing programs that will not only save water, but also save the facility money. The Climate Literacy Consortium (*Gould, 2011*) suggests eliminating the purchase and sale of bottled water and increasing the use of water-filtration dispensing systems. Kaiser Permanente switched bottled water drums to filtrated tap water and saved \$61,400 annually. And Santa Rosa Memorial Hospital phased out single-use bottled water and saved \$66,000 annually (*Ebers, 2011*). The Pacific Institute estimates that in 2006, bottled water to quench American's thirst resulted in more than 2.5 million tons of carbon dioxide (a GHG, instrumental in causing climate change) and each liter of bottled water took three liters of water to produce (*Pacific Institute, 2008*).

Our current industrialized agriculture and food system is very energy intensive. It's reliance on petroleum-based resources in the form of fertilizers and pesticides, and fuel for farm operations and processing, adds substantially to climate change (*HCWH b, n.d.*). To reduce GHG emissions, hospitals can buy from local farmers' markets, local vendors and consider growing food onsite in hospital gardens. This has a co-benefit of providing fresh nutrient rich foods to the menu.

A climate change reduction strategy, the Balanced Menus Challenge, helps hospitals serve the healthiest food to benefit patients, the environment and their bottom line. One strategy of the Challenge is to reduce the meat served in hospitals, which reduces GHG emissions associated with livestock production, and offers other health benefits, such as a reduction in cardiovascular disease (*HCWH b, n.d.*).



Co-Benefits of Action

Despite consistent evidence that points to increased disease and death from climate change and resultant ozone pollution, the good news is that reducing emissions can reverse some of these trends, as well as result in economic gains (*co-benefits*). It is possible to slow the rate of harm to human health, (e.g., *asthma, cardiovascular disease*) and save money (*Costello et al., 2011*). For example, a report released by the Environmental Protection Agency (*EPA*) finds benefits of the 1990 amendments to the Clean Air Act exceeding costs for implementing the regulations by a ratio of 26 to 1 in 2010, and 30 to 1 in 2020 (*with an estimated return of over 2,400 percent in one year*).

In 2010, approximately \$1.3 trillion (*or 9 percent of the GDP*) was gained in public health and environmental benefits as a result of Clean Air Act amendments (*Johnson, 2011*) for a cost of only \$50 billion (*or .4 percent of GDP*). In 2020, it is estimated that we will experience a gain of approximately \$2 trillion (*or 14 percent of GDP*) in benefits, at a cost of \$65 billion (*or .46 percent of GDP*) with a ratio of benefits to cost at more than 30 to 1 (*EPA, 2011b*).

A series of studies (*Goodstein et al., 2010; EPA, 2011b; Hogan & Jorgenson, 1991; Jorgenson et al., 2004*), found that implementing the Clean Air Act actually increased the size of the economy. This occurred as a result of improved health and a more productive workforce that increased net economic output.

The research concluded that by 2010, the GDP was approximately 1.5 percent higher than expected as a result of the Clean Air Act, and that these findings exclude consideration of other the environmental benefits (e.g. *ecological preservation*) (*Jorgensen et al., 2004*).

CONCLUSION

Health professionals are trusted by society worldwide. They must honor the trust covenant they have with those they serve by advocating for policies and practices that will help to mitigate and adapt to climate change. “Climate change provides an opportunity to act with courage and creativity as individuals, as people of faith, as a nation. As a wealthy nation and as the top contributor to greenhouse gases, we in the United States must help to shape responses that serve not only our own interests but those the of the entire human family” (*U.S. Conference of Catholic Bishops, 2001*).

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FIGURES

FIGURE 1

AMERICAN NURSES ASSOCIATION
Global Climate Change Resolution

American Nurses Association recognizes and publicly acknowledges that the challenges we face as a result of global climate change are unprecedented in human history and it is critical that nurses speak out in a united voice and advocate for change on both individual and policy levels.

ANA, 2008

FIGURE 2

AMERICAN MEDICAL ASSOCIATION
Climate and Health, Resolution: 430 (A-08)

1. Endorse the findings of the 4th Intergovernmental Panel on Climate Change;
2. Support research to explore the human health effects of climate change;
3. Support state, federal and international policy coordination to develop adaptive strategies to respond to the predicted human health effects of climate change; and
4. Encourage Congress and the President to adopt national and international policies to reduce the emissions of greenhouse gasses.

AMA, 2008

FIGURE 3

Heat Wave Adaptation Strategies: Anticipatory guidance for patients and their families

- + When outdoors, limit physical exertion, stay in the shade, wear loose clothing and hats.
- + Take cool showers and baths.
- + Drink plenty of non-alcoholic, non-caffeinated fluids.
- + Eat lightly, avoid using stoves or ovens to heat food.
- + Educate the public on proper food refrigeration, preservation and cooking to avoid food spoiling in high temperatures and food poisoning.
- + Store water and non-perishable food in case of power loss.
- + Close curtains and blinds to keep out sunlight.
- + Use air conditioning when available or move to lower floors.
- + Identify location of and transportation to local cooling centers.
- + Establish a “buddy system.”
- + Be familiar with the signs and symptoms of heat cramps, heat exhaustion and heat stroke.

Carpenter, 2010

TABLE 1 *Center for Disease Control: Weather Events, Health Effects, and Populations Most Affected*

WEATHER EVENT	HEALTH EFFECTS	POPULATIONS MOST AFFECTED
Heat waves	Heat stress	Extremes of age, athletes, people with respiratory disease
Extreme weather events, (rain, hurricane, tornado, flooding)	Injuries, drowning	Coastal, low-lying land dwellers, low socioeconomic status (SES)
Droughts, floods, increased mean temperature	Vector-, food- and water-borne diseases	Multiple populations at risk
Sea-level rise	Injuries, drowning, water and soil salinization, ecosystem and economic disruption	Coastal, low SES
Drought, ecosystem migration	Food and water shortages, malnutrition	Low SES, elderly, children
Extreme weather events, drought	Mass population movement, international conflict	General population
Increases in ground-level ozone, airborne allergens and other pollutants	Respiratory disease exacerbations (COPD, asthma, allergic rhinitis, bronchitis)	Elderly, children, those with respiratory disease
Climate change generally; extreme events	Mental health	Young, displaced, agricultural sector, low SES

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BEFORE IT IS TOO LATE,

It is necessary to make courageous decisions that reflect knowing how to re-create a strong alliance between man and the Earth. A decisive “yes” to the protection of creation is necessary, and a firm commitment to reverse those tendencies that run the risk of bringing about situations of unstoppable degradation.



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