Addressing the Health Risks of Climate Change in Older Adults

ABSTRACT

Our climate is changing. These changes have an impact on health, especially in vulnerable populations such as older adults. Many older adults lack the physical, cognitive, social, and economic resources to avoid and/or mitigate the effects of exposure to extreme weather events. The purpose of the current article is to help nurses understand climate change and how that relates to the need for specific interventions to support climate adaptation for the older adult population. A model of exposure, contact to stressors, and adaptive capacity are used to address the health needs of older adults in the face of climate change. Gaps in nursing knowledge, resources for nurses, and a proposed agenda for research and practice in climate change are offered. Gerontological nurses are in an important position to lessen the harm of climate change in older adults through practice, research, and policy. [Journal of Gerontological Nursing, 45(11), 21-29.]

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“How could we explain to our grandchildren that we saw the threat coming, but did not do all we could to ensure that humankind took the necessary precautions?”

—Michael Mann (The Hockey Stick and the Climate Wars, 2013, p. 251)

Our climate is changing. Evidence clearly shows that humans are warming the planet, and these climate changes have a devastating impact on health, especially in the most vulnerable populations, such as older adults (Costello et al., 2009; Watts et al., 2015). Climate change is a health and nursing issue. Despite this evidence, there is a large gap in nursing knowledge of climate change and a paucity of nursing research on climate change and health. Few nurses understand climate science in an accessible way or can communicate why extreme weather events, including extreme and snowy winter weather, are related to climate change (Anaker, Nilsson, Holmner, & Elf, 2015; Polivka, Chaudry, & Crawford, 2012) and how these changes affect the health of older
adults. Because of these gaps, few nurses know ways to lessen the impact on older adults or interventions that can be tested in health care settings (Leffers, McDermott-Levy, Nicholas, & Sweeney, 2017). Climate change will impact the health of all populations, but for older adults there are unique vulnerabilities, such as normal physiological changes of aging, comorbidities, cognitive impairment, and mobility limitations. Gerontological nurses must be prepared to address these specific issues of older adults in all practice settings.

The purpose of the current article is to help nurses understand climate change and the need for specific interventions to support climate adaptation for the older adult population. What makes older adults particularly vulnerable and gaps in nursing knowledge will be discussed and resources for nurses and other clinicians and a proposed agenda for research and practice in climate change will be presented.

OVERVIEW OF CLIMATE SCIENCE

In October 2018, the United Nations Intergovernmental Panel on Climate Change (IPCC), comprised of the world’s leading climate scientists, issued a sobering report. If greenhouse gas emissions continue at the current rate, Earth’s surface temperatures could rise to 2.7°F (1.5°C) above preindustrial levels by 2030 and this could have catastrophic impacts on human health (IPCC, 2018). Climate change is not something nurses typically think about, but it has the potential to influence the health of older adults in a significant way. As older adults experience changing weather patterns from climate change, gerontological nurses should be asking:

- How does climate change influence the health of older adults?
- How could gerontological nursing practices promote and maintain the health of older adults in relation to climate change?

To answer these questions, it is important for nurses to understand basic climate science and its impact on the older adult population.

There are naturally occurring and human (anthropogenic) factors that contribute to climate change. Naturally occurring factors include changes in the sun’s warming energy on Earth (irradiance) and volcanic eruptions that eject sun-blocking particles into the stratosphere (Mann & Kump, 2015; U.S. Global Change Research Program [USGCRP], 2018). Natural factors, however, cannot explain the recent warming that has been observed. Indeed, between 1951 and 2010, natural factors alone contributed to a slight cooling trend (between −0.18°F and 1.8°F and −0.1°C to 0.1°C) (USGCRP, 2018). The approximate mean 1°C (range = 0.8°C to 1.2°C) of global warming (i.e., the entire observed global warming trend) is attributed to human activity.

Anthropogenic greenhouse gas emissions are the dominant human-caused contribution to observed climate change. The dominant anthropogenic greenhouse gas is carbon dioxide (CO₂), whereas methane (CH₄) plays a secondary but important role, and ozone, nitrous oxide (N₂O), and halocarbons play a tertiary role (USGCRP, 2018). Burning fossil fuels (e.g., coal, gas, oil), agricultural practices, and deforestation are the greatest contributors of the two major greenhouse gases, CO₂ and CH₄. Greenhouse gases become part of Earth’s atmosphere and they absorb heat. Atmospheric heat absorption by natural greenhouse gases is helpful to keep Earth habitable (i.e., in the absence of any greenhouse effect, Earth would be a frozen planet). However, when greenhouse gases reach high atmospheric levels, they act as if an extra blanket has been wrapped around Earth and too much heat is held on Earth’s surface. Particulates known as aerosols produced by coal-burning and other industrial activities (particularly sulphate aerosols) have a regional cooling effect and have offset some of the greenhouse warming during the past century, but the aerosol cooling has decreased in recent decades, leading to an acceleration of global warming over that time frame.

Increases in atmospheric greenhouse gases have led to a sick Earth with myriad symptoms that affect human health. Unprecedented weather extremes have been seen in the United States in recent decades, including record-strength hurricanes and super storms, floods, droughts, heat waves, and wildfires. These events are the result of a warmer atmosphere that can hold more moisture, which allows for more extreme precipitation events, including floods and winter blizzards, and stronger, more rainfall-producing hurricanes (Mann & Kump, 2015). The warming of the surface also leads to drying soil and worse drought in many regions. In addition, increasing atmospheric CO₂ has caused the oceans to absorb additional CO₂ and heat. In fact, the oceans have absorbed 55% of the industrial period CO₂ (Mann & Kump, 2015) and 93% of the excess heat energy (USGCRP, 2018), contributing along with the melting of glaciers and ice sheets to sea level rise. Rising sea levels along with more intense land-falling hurricanes have led to the inundation of coastlines. Increasing CO₂ levels have also led to acidification of oceans with decreased marine life and seafood (National Oceanic Atmospheric Administration, 2017). The latitudinal pattern of warming, and in particular Arctic amplification of warming due to melting ice and other feedbacks, may also be favoring stalled, extreme weather patterns. Thus, an extreme rain or snowstorm or heat wave may last many days (Mann, 2019; Mann et al., 2018) (Figure 1).
WHAT MAKES OLDER ADULTS VULNERABLE TO CLIMATE CHANGE HEALTH THREATS?

Climate change is an environmental stressor. Vulnerability to climate change, like other health risks, is determined by three elements: exposure, the contact people have with the stressor; sensitivity, the degree to which people are affected by the stressor; and adaptive capacity, the ability of people to adjust to the stressor (Crimmins et al., 2016). Many factors span all three elements; for example, socioeconomic status can impact exposure (poor housing), sensitivity (poor health due to lack of access to health care), and adaptive capacity (inability to afford air conditioning). Vulnerability also operates at individual, community, and national levels, and these levels are inextricably interrelated.

Climate change has a differential impact on subgroups of the population depending on their vulnerability. Older adults have been designated a population of concern because of their heightened vulnerability (Balbus & Malina, 2009; Layva, Beaman, & Davidson, 2017). Exposure

The geographic distribution of older adults in the United States is such that more than one half live in areas that disproportionately experience the effects of heat waves, forest fires, hurricanes, and coastal flooding, California, Florida, Texas, New York, and Pennsylvania account for the top five states where older adults are concentrated (U.S. Department of Health and Human Services [USDHHS], 2018). Older adults who live in urban areas are vulnerable to the “heat island effect”—the relative warming of urban areas compared to rural areas due to the displacement of the natural environment with a built environment that traps heat. Trapped heat does not dissipate at night, leading to a disruption in the pattern of nighttime cooling when the body could recover from high daytime temperatures in cities (Opitz-Stapleton, 2014).

A substantial number of the 51.1 million older adults in the United States live on fixed incomes and >15 million are economically insecure—living at or below 200% of the federal poverty level (Cubanski, Koma, Damico, & Neuman, 2018). Poor housing and substandard communal living sites that lack basic necessities, such as air conditioning and access to social services during extreme weather events, increase older adults’ exposure to the effects of climate change. Older adults’ vulnerability to extreme weather events brought on by climate change was graphically illustrated during Hurricane Katrina when approximately 60% of the flood-related deaths were among people older than 65 (Jonkman, Maaskant, Boyd, & Levitan, 2009).

Sensitivity

Physiological age changes, comorbidities, loss of functional abilities, certain medications, and social isolation increase older adults’ sensitivity to the effects of climate change. Older adults have a reduced thermoregulatory response to heat and cold because of physiological changes in the regulation of core body temperature. The ability to sense heat, sweat, and increase skin blood flow are all reduced in healthy older adults. Risk for heat-related illness or injuries are compounded for older adults with obesity, cardiovascular disease, respiratory disease, and diabetes mellitus because of the deleterious effects these diseases have on normal thermoregulatory responses (Gamble et al., 2013).

Older adults often have a heavy drug burden due to their multiple comorbidities. Many of these medications can increase sensitivity to the effects of climate change by inducing diuresis, electrolyte imbalance, and sedation, and by reducing thirst recognition, sweat production, and cardiac output. Diuretics (especially...
when combined with an angioten-
sin converting enzyme inhibitor or
angiotensin II receptor blocker),
anticholinergic, and psychotropic
medication compromise thermo-
regulatory capacity and can lead to
heat-related illnesses (Westaway et
al., 2015).

Other factors increase older
adults’ sensitivity to climate change
effects. A recently released govern-
ment report indicated that 49.8% of
adults age >65 have a disability that
places them at risk of being “invis-
ible” during extreme weather events
(Gamble et al., 2016). Older adults
who have cognitive impairments or
mobility problems may not receive
the assistance they need to evacu-
ate during a flood or wildfire. These
problems become even more exag-
gerated in socially isolated areas
where there are few available social
services.

Adaptive Capacity

Many older adults lack the physi-
cal, cognitive, social, and economic
resources to avoid and/or mitigate
the effects of exposure to extreme
weather events. Functional limita-
tions and mobility impairments are
more common in older women than
men. Osteoporosis, impaired bal-
ance, and reduced motor strength
make it difficult to evacuate and
respond to weather emergencies.
Women also experience higher
rates of comorbidities and certain
neurodegenerative diseases (e.g.,
Alzheimer’s disease) that interfere
with thermoregulation and the judg-
ment necessary to assess and take
action against risks associated with
extreme weather events, respectively
(Gamble et al., 2013).

Socioeconomic status directly
impacts the susceptibility of older
adults to climate change, and racial
and ethnic populations are dispro-
portionately represented among the
health risks associated with cli-
mate change and ways to avoid nega-
tive health outcomes (Gamble et al.,
2013). Gerontological nurses can
leverage their expertise to inform
older adults and their families, other
health care providers, health facility
administrators, community-based
organizations, and policy makers of
the unique needs of an older adult
population. For example, geronto-
logical nurses can address the prepa-
ration for and response to extreme
weather events within the context
of the geographic region (e.g., heat,
flooding, wildfires) and older adults’
living setting. Ability to access emer-
gency information and early warn-
ing systems (e.g., television, radio,
phone, internet) should be assessed
to determine if older adults are able
to protect themselves during and
after extreme weather events. Older
adults with special needs, such as
those with cognitive impairments,
mobility issues, or mental health
problems, should be identified to
local emergency management agen-
cies to ensure they receive necessary
evacuation assistance (Balbus &
Malina, 2009; Federal Emergency
Management Agency, 2006).

Poor air quality from the chang-
ing climate and extreme weather
events (Fiore, Naik, & Leibensper-
ger, 2015) can negatively influen-
ced older adults who already have
decreased lung capacity (Miller, 2019).
In the past 20 years, pollen season
in the United States is earlier and
with higher concentrations (Poole
et al., 2019). In addition, in higher
temperatures, pollen has greater im-
munoglobulin E binding, thus cre-
ating a stronger allergic response
(Ahlholm, Helander, & Savolainen,
1998). For this reason, older adults
may display new allergy symptoms
during pollen season. Nurses should
monitor and teach older adults or
their caregivers to monitor the air
quality index (AQI), which can be
found in the newspaper, news radio,
Environmental Protection Agency
(EPA) website (access https://airnow.
Climate change can also cause extremely cold weather. Accidental hypothermia can occur even without severe cold exposure in older adults who have mobility problems, comorbidities that interfere with heat production or impair thermoregulation (e.g., hypothyroidism, diabetes, stroke, acute illnesses), or are using medications that interfere with thermoregulation (e.g., tranquilizers, sedative/hypnotics, antidepressants, vasodilators). During cold periods, older adults should be instructed to dress warmly, layer clothing with high insulation value (avoid polyester), wear a hat indoors to prevent heat loss, and take advantage of fuel assistance programs in the community (Worfolk, 2000).

Emergency Evacuation Plan
During extreme weather events, such as hurricanes and wildfires, news reports frequently highlight the unique vulnerabilities of older adults. Access to services and mobility influence health risk for older adults. Nurses, along with other providers, can play an important role in supporting individual resilience in the face of emergencies by supporting coping strategies, personal strength, disaster preparation, and behaviors that support health (Layva et al., 2017). Gerontological nurses in all practice settings should assure that older adults and their caregivers are aware of community-level emergency procedures, communications, and evacuation plans. The Office of Homeland Security has partnered with other federal agencies to offer home emergency preparedness information in several languages, including Spanish, Arabic, Chinese, and Russian. In addition, there is a section that specifically addresses the needs of older adults (access https://www.ready.gov/seniors). Nurses must be aware of the federal, state, local, and agency-based emergency procedures in their region and assure that there are contingency plans for loss of power for home and clinical settings, including hospitals; alternative evacuation routes; and a variety of communication methods that specifically address the needs of older adults with comorbidities; mobility, sensory, and cognitive problems; and supportive devices (e.g., oxygen tanks).

During disasters and emergencies, an 1135 Waiver can be requested for Medicare and Medicaid–funded health providers, laboratory services, skilled nursing care, hospital services, and mental health counseling (USDHHS, 2019). In some states, an older adult who requires assistance during emergencies can be registered through the state 2-1-1 Essential Community Service Hotline; in other states, the local emergency services such as police and fire would be made aware of the address of a person in the event of an emergency evacuation. AARP (n.d.) has a Livable Communities initiative that includes disaster planning to support older adults in advance of an extreme weather event. Gerontological nurses should support the adoption of Livable Communities locally and institutional-level (e.g., nursing home, hospital) disaster plans that include the unique needs of older adults.

Adapting Plan of Care
Climate change impacts require modifications in health plans for older adults. As mentioned above, prolonged heat will require greater needs for hydration, but comorbidities must be considered. Individuals with heart failure and renal disease will require astute nursing assessments to monitor the balance of hydration and electrolytes while not leading to fluid overload or electrolyte imbalances in the presence of extreme heat. Older adults with or at risk of heat stroke and dehydration should be assessed for delirium (Oh, Fong, Hsieh, & Inouye, 2017). In addition to fluid balance, older adults with cardiovascular and respiratory conditions must have pro-
visions in their plan of care for bad air days. Outdoor activities should be limited when the AQI is >50 for any criteria air pollutant (EPA, n.d.). Astute cardiovascular and respiratory nursing assessments and responses are needed to maintain homeostasis for older adults. Plans of care that involve taking the older adult outdoors when the AQI is >50 for someone with cardiovascular or respiratory disease may need to be modified.

The stress and anxiety created by extreme weather events and disasters can affect the mental and cognitive health of older adults. Disruption of services and relocation as the result of an evacuation can be anxiety provoking and confusing to a person with dementia (Miller, 2019). These events may precipitate delirium. Well-trained and sufficient nursing staff and volunteers can help reduce confusion and anxiety. Planning for and supporting personal and community resilience before events can reduce stress and its effects at the source.

Medications are an important part of disease management and prevention of disease complications. In addition to heat-related impacts to medications listed above, nurses in all practice settings must consider medication storage and medication accessibility during disasters and evacuations. Medications that do not need to be refrigerated should

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>RESEARCH, PRACTICE, AND POLICY AGENDA FOR CLIMATE CHANGE</th>
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<tbody>
<tr>
<td>Research Agenda</td>
<td>Practice</td>
</tr>
<tr>
<td>Develop research designs for studying the impact of health and climate change with older adults as partners</td>
<td>Assess and document factors that may impact older adults’ response to extreme weather</td>
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<tr>
<td>Identify predictors that make older adults more vulnerable to specific health impacts of climate changes (e.g., pollution, extreme weather)</td>
<td>Identify and address (assess and act) key areas of vulnerability and risk in older adults in regard to climate change including: hydration, temperature control, adapting the plan of care, medications, and mental health and intellectual disability issues</td>
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<td>Establish interdisciplinary research teams to develop comparison groups nationally and internationally and support nurse scientists in this arena</td>
<td>Locate resources in your area and local disaster plans before extreme weather events occur</td>
</tr>
<tr>
<td>Develop measures to better understand the climate-related experience of older adults</td>
<td>Educate about and work with your local community to understand who is most at risk and how to mitigate and adapt to climate risk</td>
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<td>Establish cost-effective replicable programs to lessen the impact of climate changes on older adults</td>
<td>Educate for climate mitigation: ways to reduce greenhouse gases individually and conserve energy, minimize waste and pollution, support local food sources, and commute in ways that decrease carbon emissions</td>
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<td>Identify programs to better understand how nurses can decrease greenhouse gases in their health systems</td>
<td>Encourage health systems to join Practice Green Health and Health Care Without Harm (see Table 2 for websites) Nurses should join Alliance of Nurses for Healthy Environments Climate Change Committee and the Nurses Climate Challenge (<a href="https://nursesclimatechallenge.org">https://nursesclimatechallenge.org</a>)</td>
</tr>
<tr>
<td>Test effective methods of climate risk communication for older adult populations</td>
<td>Address barriers to and facilitators of hyperthermia and hypothermia in your local setting and community</td>
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be kept in a dry place. A review of medication storage advisories in the media during heat waves found that medications should be stored at room temperature between 58°F and 86°F (14.4°C to 30°C) (Smith Caldwell Drug Store, 2015). To maintain potency, medications should not be in areas >86°F (Konrad, 2011); therefore, if it is hot in the home or clinic, medications need to be stored in a cooler place. Nurses should teach older adults to keep medications together, refilled, and have a current list of medical problems, health providers, and medications (dose and frequency) available and a copy with family or a friend in the event of an emergency evacuation.

**IMPLICATIONS FOR PRACTICE, RESEARCH, AND POLICY**

There is a growing body of evidence on the impact of climate change on health and the health of older adults. The current article seeks to help nurses understand climate change and the need for specific interventions that support adaptation for the older adult population. Climate change is a direct threat to the health of older adults and there are interventions that can be implemented individually and collectively by nurses to lessen the burden for older adults. Older adults are particularly vulnerable to cardiovascular, respiratory, heat, and dehydration issues. Climate change requires a response that includes not just nursing but also government, communities, health care systems, society, and the world as a whole. There is much more work to be done; hence, the following research, practice, and policy agenda is proposed for nurses and health care leaders to consider in addressing climate change (Table 1).

Recent studies have addressed the issue of nurses and climate change (Cook, Demorest, & Schenk, 2019); however, the current article is one of the first to identify practice, research, and policy issues for climate change in older adults. Nurses play an important role in policy and practice in being aware of and educating others on the threat of climate change on the health of older adults, taking steps to lessen the harm and burden to older adults, altering their own behavior to slow the trajectory of climate change, being active in societal efforts to address climate changes, and being aware of steps to take within their own practice or health care system to reduce their pollution and waste and conserve energy. Nurses can design and participate in research to better document and measure the harm and impact of climate change on older adults and can advocate for policies that support older adults in disasters or extreme weather events. Nurses can also join
or learn more about organizations that are resources for education about climate change, address best practices for health care organizations, and share sustainable practices within their own communities and with older adults (Table 2).

CONCLUSION

It is everyone’s responsibility to learn about climate change and participate in slowing the trajectory of climate change. Gerontological nurses are in an important position to lessen the harm of climate change in older adults in practice, research, and policy.

REFERENCES


Polivka, B. J., Chaudry, R. V., & Mac Crawford, J. (2012). Public health nurses’ knowledge and attitudes regarding climate change. Environmental...
Health Perspectives, 120(3), 321–325. https://doi.org/10.1289/ehp.1104025 PMID:22128069


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