Health Impacts of Climate Change: ACP Perspective

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The health impacts of climate change demand immediate action. The science is clear; communities across the nation are experiencing the health impacts of climate change. The most vulnerable disproportionately bear the health impacts of climate change. Bold action is needed and other greenhouse gases, including power plants, cars, trucks and other mobile sources.
The Basics

- *Damage to the climate* is real and it’s happening now.
- Human activity emits greenhouse gases (like CO₂) into atmosphere, gases trap heat in atmosphere, altering the Earth’s climate.
- It could pose a catastrophic threat to the planet and human health...
- ...BUT with a concerted action we create healthy and safe communities for our families and children.
- Addressing climate change could have major co-benefits – improved air quality, better physical and mental health.
NOAA: Climate Model Indications and the Observed Climate
Damage to the Climate – It’s Already Happening

• “Warming of our climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.” (IPCC, 2013)
Sea and Land Ice is Dwindling...

- NASA: “In 2012, Arctic summer sea ice shrank to the lowest extent on record.” In 2017 Arctic wintertime sea ice extent was at a record low (1).
- Antarctica and Greenland land ice sheets are losing mass. Greenland ice loss doubled between 1996 and 2005 (NASA)
...and Sea Level is Rising

- Global sea level has risen *8 inches* since the beginning of the 20th century.
- Sea level increase is the result of warmer oceans (ocean absorbs heat, water expands), and melting land ice.
U.S. Regional Effects of Climate Change

**Northwest U.S.**

- Changes in streamflow timing and snowpack could affect water supply.
- Drier conditions and higher temperatures may also enhance the risk of wildfires leading to respiratory problems, stress from displacement, and other issues.
U.S. Regional Effects of Climate Change

**Midwest**

- Observed effects of climate change include increased extreme precipitation and flooding
- Projected effects in the region include more frequent and extreme heat waves, poorer water and air quality, and extreme rainfall events and flooding.
Montana Climate Assessment: Historical

- Annual average temperatures, including daily minimums, maximums, and averages, have risen across the state between 1950 and 2015. The increases range between 2.0-3.0°F (1.1-1.7°C).

- No historical changes in average annual precipitation between 1950 and 2015. All emission scenarios throughout the 21st century.
Montana Climate Assessment

- By mid century, Montana temperatures are projected to increase by approximately 4.5-6.0°F (2.5-3.3°C)
- Precipitation is projected to increase in winter, spring, and fall; precipitation is projected to decrease in summer.
- Montana’s snowpack has declined over the observational record (i.e., since the 1930s) in mountains west and east of the Continental Divide; this decline has been most pronounced since the 1980s.
- Historical observations show a shift toward earlier snowmelt and an earlier peak in spring runoff in the Mountain West (including Montana). Projections suggest that these patterns are very likely to continue into the future as temperatures increase.
- Earlier onset of snowmelt and spring runoff will reduce late-summer water availability in snowmelt-dominated watersheds.
- Groundwater demand will likely increase as elevated temperatures and changing seasonal availability of traditional surface-water sources (e.g., dry stock water ponds or inability of canal systems to deliver water in a timely manner) force water users to seek alternatives.
- Multi-year and decadal-scale droughts have been, and will continue to be, a natural feature of Montana’s climate rising temperatures will likely exacerbate drought when and where it occurs.

Climate Change Impacts Human Health

Impact of Climate Change on Human Health

- Injuries, fatalities, mental health impacts
- Asthma, cardiovascular disease
- Heat-related illness and death, cardiovascular failure
- Malnutrition, diarrheal disease
- Forced migration, civil conflict, mental health impacts
- Extreme heat
- Environmental degradation
- Water and food supply impacts
- Water quality impacts
- Cholera, cryptosporidiosis, campylobacter, leptospirosis, harmful algal blooms
- Malaria, dengue, encephalitis, hantavirus, Rift Valley fever, Lyme disease, chikungunya, West Nile virus
- Respiratory allergies, asthma
- Changes in vector ecology
- Increasing allergens
- Extreme weather
- Rising temperatures
- More extreme weather
- Sea level rise
- Depletion of resources

LINK
Respiratory disorders, including asthma and allergies

- Higher temperatures and increased pollen load may exacerbate respiratory problems. Elevated ground-level ozone concentrations could affect lung function.

- In 2012, 7 million deaths were connected to the joint effects of outdoor ambient air pollution and household indoor air pollution, according to the WHO. Globally, climate change could be responsible for 60K air pollution-linked premature deaths in 2030 and 260K by 2100 under current emission trends (1).

- Pollen season has lengthened in central North America as temperatures have risen and the frost-free period has extended (1).

- Elevated carbon dioxide concentration may facilitate the increased growth of allergen-producing weeds grasses, trees and fungi.(1, 2)

- Heavy rainfall and flooding can cause dampness in homes, potentially leading to indoor mold and fungal growth, associated with nasal and throat symptoms, coughing, wheezing, asthma exacerbation, and other problems.(1, 2)
“CARMAGEDDON”? Los Angeles, CA 405 Freeway

Ultrafine Particulates down 83 %
PM2.5 down 36 percent

ER Visits UCLA down 23%
ER Visits Mt Sinai down 13%
911 calls decreased 12%

Y Zhu, WC Hinds, S Kim, C Sioutas - Journal of the air & waste ..., 2002 - Taylor & Francis
For every 10 ppb ozone heat related
smokier

- Elder Admits: 70%
- Ped Asthma Admits: 34%
Hotter means:
sicker

for every 10 degrees F above seasonal average

8% premature births

for every 2 degrees F above seasonal average

5% elder deaths
MORE CO₂ MEANS BIGGER, MORE AGGRESSIVE POISON IVY

15 mg  40.9 mg  53.3 mg  78.1 mg
1950  TODAY  2040-2050  2060-2070

TOXIC OIL PER PLANT

Average per plant in Ziska (2007) lab study

CLIMATE CENTRAL
Montana’s annual fire season is 78 days longer, compared to the 1970’s. 6 x as many acres are burned.
Food security problems and water scarcity

- As the population grows and food demand rises, "climate change could result in an increase of 20% of people at risk of chronic hunger." (1)
- Under some forecasts, rice, maize, and wheat crop yields may suffer in areas that do not implement adaptation plans; in high elevation areas, yields may increase with the temperature. (1)
- Water scarcity may be accelerated as the climate changes and more regions experience drought. Risk is especially pronounced in presently dry regions.
- One study estimates that about 100 million additional urban dwellers will experience perennial water shortages under climate change conditions than under current climate. (1)
In a real-world study of CO$_2$ and soybeans

1. Aphids and Japanese beetles were drawn more to plants raised in elevated CO$_2$ conditions.

2. Beetles that fed on the high CO$_2$ leaves lived longer and laid more eggs.

3. The high CO$_2$ levels also lowered the plants’ natural defenses, making them virtually helpless against plant-eating pests.
CO₂, Global Warming and Crops

- Increased CO₂ decreases protein content in grains

- Zinc and iron content are also decreased.

- Increased temperature decreases productivity of grains

Nature 2014; 516: 139-42.
www.worldwatch.org/node/572
Current research indicates that…

- For every day during the growing season that temperatures go above 29°C (84°F), maize yields decline by 0.7%.

- By the end of the century, U.S. maize yields could fall by 1/3 from heat stress alone.
A warmer climate and changing rainfall patterns may also create hospitable environments for climate-sensitive vectors like mosquitos and ticks that spread diseases like Lyme disease, West Nile virus, and chikungunya (1, 2).

Some models predict that climate change could be a factor in extending Lyme disease into Canada. (1)

Water-borne diseases may also thrive in flooded regions as well as those where water is scarce.

For example, cholera may develop and spread in drought-stricken areas where lack of water leads to poor sanitation (1).
Tropical Diseases on the Move

*The exact point of origin of many diseases is uncertain*
Mental health disorders, including post-traumatic stress disorder and depression connected to natural disasters.

• Disasters caused by climate change may have a negative effect on mental health. Extreme weather events can cause stress that may result in a decline in mental health and prolonged heat or cold events may cause chronic stress problems that exacerbate health issues (1)
• Mental health problems can occur due to displacement, relocation and loss of property and personal finances in the aftermath of a disaster. (1)
• Nearly half of surveyed New Orleans residents affected by Hurricane Katrina reported anxiety mood disorder and a substantial number reported post-traumatic stress disorder. (1)
• The U.S. military considers climate change to be a “threat multiplier,” a factor that exacerbates existing problems, such as food insecurity, pandemic disease, and conflict over resources. (1)
Climate Change May Already Be Hurting Your Patients

• As physicians, we are on the front lines of this problem – and our patients may already be experiencing the effects.
  • A survey of American Thoracic Society members found that 77% of respondents believed increases in the severity of chronic illness resulting from increased air pollution as a consequence of climate change.(1)
  • A survey of American Academy of Allergy, Asthma, and Immunology members found that 63% indicated their own patients had increased allergic symptoms associated with climate change.(1)
  • 61% of members of the National Medical Association survey respondents indicated that their own patients were already being harmed by climate change “a great deal” or “moderately.”(1)
Climate Change Mitigation: The Key to Stopping Further Climate Change

• Climate change mitigation is the goal of “implementing policies to reduce greenhouse gas emissions and enhance sinks,”(1) including
  • more efficient use of energy
  • expanded use of carbon neutral or low-carbon energy
  • reductions in deforestation and increases in reforestation
  • lifestyle and behavioral changes (such as energy conservation and reduced energy demand).
Mitigation could have major health benefits

**Action**
- Increasing safe active transport and use of lower-emission vehicles
- Increase use of clean-burning stoves
- Reduction in use of coal-generated electricity

**Outcome**
- Reduce heart disease, cerebrovascular disease, dementia, depression(1)
- Reduce indoor air pollution exposure, respiratory illness(1)
- Lower air pollution, better respiratory health
ACP Recommendation

• The health care sector, within the United States and globally, must implement environmentally sustainable and energy-efficient practices and prepare for the impacts of climate change to ensure continued operations during periods of elevated patient demand.
The Health Care Industry is One of the Largest Consumers of Energy

• The health care sector is ranked second in energy use after the food industry

• It spends over $9 billion annually on energy costs (1)

• Power plant emissions are connected to premature deaths, chronic bronchitis, asthma attacks, emergency room visits and more.(1)

• Hospitals in the United States produce a massive amount of garbage/waste (>2.3 million tons per year)
Green Transportation Strategies

- Transportation accounts for 27% of Total U.S. Greenhouse Gas Emissions (1)
- **Reduce fleet emissions** – *Hospital fleets to include high-fuel efficiency, hybrid, alternative fuel vehicles*
- **Help commuters reduce emissions** – *Encourage use of mass transit, carpooling, telecommuting for employees; shuttles to public transit; active transportation like walking and cycling*
- **choose suppliers with efficiency or alternate-fuel standards**
- **prefer local suppliers** – *reduce transportation and shipping distance, fuel consumption*
- **purchase energy-efficient shipping** – *choose lighter products with less packaging, encourage environmentally sustainable packaging (1)*
Case Study: Seattle Children’s Hospital

- Hospital proposed **Comprehensive Transportation Plan** (1)
  - Reduce vehicle traffic by shuttle links to transit hubs, parking changes, encourage carpooling, free transit for employees, vanpool service
  - Make area more walk-, cycling-friendly through capital investments that link hospital and surrounding community to larger walking/biking networks, free bikes to employees who pledge to bike to work, cash for those who don’t drive to work, on-site bike maintenance, discounts on gear from in-house bike shop.

- “Seattle Children’s Hospital is already more than halfway to its goal of getting from 50 percent car commuting to 30 percent.” (1)

- Drive-alone commuting trips by employees down from 73% in 1995 to 38% in 2015
Reduce Your Facility’s Energy Use

• Make buildings more energy efficient – switch to energy efficient light bulbs (CFLs, LED bulbs), turn down thermostat, upgrade major equipment to most energy-efficient model; optimize building envelope with insulation and energy-efficient windows

• Install On-Site Renewable Energy Capability - Solar panels can generate a portion of facility’s energy, solar hot-water heating system


• Reduce Standby Energy Use – Plug computers/electronic equipment into power strip and turn off when not in use.

• Purchase Green Power – Use power generated from renewable sources like wind, solar.
Case Study: Boston Green Ribbon Commission Health Care Working Group

- Nearly all major Boston-area hospitals participate. Commission’s goal is 25% drop in GHG emissions by 2020, 100% by 2050
- Member hospitals achieved cuts in electricity, natural gas use, GHG reductions for all fuels.
- Sector energy use dropped by 9.4% from 2011-2015, “avoiding greenhouse gas (GHG) emissions equivalent to 126 million miles traveled by an average passenger vehicle.”
- 100% of Partners HealthCare energy is from zero emission sources. Boston Medical Center expects to be 92-100% carbon neutral by 2018. (1)
- Cost savings conservatively estimated at $15 million, enough to pay for healthcare for 1,357 Massachusetts Medicare enrollees.
The Built Environment

• **incorporate green building principles** – *Use day lighting, natural ventilation, green roofs; maximize energy efficiency with better insulation and energy-efficient windows, other ways to optimize building envelope.*

• **consider overall transportation impacts of facility siting** – *Site facility near public transportation hub, build in developed areas.*

• **use native vegetation and plant trees on site, use local and regional building materials** – *Trees, vegetation can reduce heat island effect, act as carbon sinks, native plants need less water.*

• **offset emissions from building construction** – *less energy required to transport local products to building site.*

• **purchase only lumber products certified by the Forest Stewardship Council** – *support sustainable forestry practices.*
Case Study: Group Health Puyallup Medical Center

- Washington State facility first in nation to receive LEED for Healthcare Gold certification. (1)
- Facility includes ground-level vegetation and green roof
- Designed for water use reduction – Special sensors activate cold water for cooling sanitized medical equipment only when necessary
- Uses a more efficient steam generator boiler
- Used local and/or recycled construction materials
- Car charging stations and bike racks on site.
Reducing Health Care Waste for a Healthier Future

• **recycle and buy recycled products** – *Recycle all recyclable products, including electronics*

• **collect and recycle nitrous oxide anesthetic gases** – *limit the amount that escapes into atmosphere during use*

• **dispose of waste locally** – *Local disposal reduces travel-related emissions*

• **prevent waste** – *through recycled material use, reduced use of virgin material, reducing amount of wasted material*

• **divert at least 90% of constructed waste** – *produced during construction and demolition*
Case Study: Virginia Mason Single-Use Device Reprocessing Project

- Single-use devices, including arthroscopic/orthopedic, laparoscopic devices, end up in landfills and use energy during manufacturing, disposal and transport.
- VM worked with a reprocessing vendor to help them reduce costs and waste.
- Reprocessed devices must meet FDA safety standards
- Physicians on leadership team were consulted and visited reprocessing facility to observe quality control and inspection process.
- As a result purchasing costs dropped by $3 million since 2012, in 2014 VM reported it had reprocessed or recycled nearly 19,000 pounds of devices.

- Education about benefits of reprocessing and sharing clinical data and research on the quality and safety comparability of reprocessed devices is key to achieving support. (1)
Green Tips for Small Practices

- **Energy Efficiency** – Turn off electronics when not in use; install energy-efficient lighting; lower thermostat 74F in summer, 68F in winter

- **Renewable Energy** – Purchase renewable energy from your utility company (or credits)

- **Water Efficiency** – Use tap instead of bottled water, promptly fix water leaks, install efficient fixtures.

(Source: My Green Doctor)
Food Service: Healthy Food, Healthy Planet

• **Reduce the amount of meat protein on menus** – Agriculture/meat protein production is a major source of greenhouse gas emissions. If Americans ate beans instead of beef, U.S. would meet up to 75% of GHG reduction goals in 2020 (1).

• **buy local and seasonal food** – reduce long-distance food transport leads to lower emissions

• **compost food waste** - creates a recycled product (compost) that can replace fertilizer.

• **eliminate bottled water** – encouraging tap water use will reduce waste.
Meat/Dairy: All Things in Moderation!

- Associated with increase cancer risk, esp. red meat
- Low meat diet could reduce climate change prevention costs 50%
having 10 more trees in a city block, on average, improves health perception in ways comparable to an increase in annual personal income of $10,000 and moving to a neighborhood with $10,000 higher median income or being 7 years younger.
Adaptation Strategies

• The Lancet Commission report on Health and Climate Change states that “tackling climate change could be the greatest global health opportunity of the 21st century.”

• Switching from fossil fuel-generated electricity to clean energy sources will reduce air pollution and lower rates of respiratory and cardiovascular illness.

• Using active transportation like walking or cycling to make short trips can improve cardiovascular health.

• Planting trees and installing green roofs reduces the urban heat island effect, lessening heat – related illness risk.

• Eating less meat and more locally grown fruits and vegetables reduces carbon pollution and promotes better cardiovascular health.
• **Cost of cleaner energy:**
  \(< \$30/\text{tCO}_2\)

• **Benefits of cleaner energy:**
  • \(\$200^*/\text{tCO}_2\)

  WHICH NUMBER IS BIGGER???

(*) Range: $50 to $380

For E. Asia, co-benefits are **10 to 70 times** greater

West et al. 2013
Moving away from fossil fuels would prevent EACH YEAR in the US:
13,200 premature deaths, 9700 hospitalizations,
20,000 heart attacks, saving $100-120 billion
Lancet June 22, 2010 & 2015; Clean Air Task Force-2011
National Academy of Sciences-2009
More Resources

- Intergovernmental Panel on Climate Change (IPCC) - http://www.ipcc.ch/
- Health Care without Harm (U.S./Canada) - https://climatecouncil.noharm.org/
- My Green Doctor - http://www.mygreendoctor.org/
- Medical Society Consortium on Climate and Health – https://medsocietiesforclimatehealth.org/
- Energy Star - https://www.energystar.gov/