Eminent Climate Change and Responsibilities of the Occupational and Environmental Medicine Physician

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Harvey hitting the Gulf Coast
Flooding
A section of Highway 90 between Devers and Nome on Thursday.
Major U.S. Climate Trends

Rising Temperatures
U.S. average temperature has increased by 1.3°F to 1.9°F since record keeping began in 1895. Warming has been the greatest in North and West while some parts of the Southeast have experienced little change.

Wildfires
Wildfires in the West start earlier in the spring, last later into the fall, and burn more acreage.

Heat Waves
Heat waves have become more frequent and intense, especially in the West.

Drought
Drought has increased in the West. Over the last decade, the Southwest has experienced the most persistent droughts on record.

Cold Waves and Winter Storms
Cold waves have become less frequent and intense across the Nation. Winter storms have increased in frequency and intensity since the 1950s and their tracks have shifted northward.

Extreme Precipitation
Heavy downpours are increasing nationally, especially over the last three to five decades. The largest increases are in the Midwest and Northeast.

Floods
Floods have been increasing in parts of the Midwest and Northeast.

Hurricanes
The intensity, frequency, and duration of North Atlantic hurricanes, as well as the frequency of the strongest (category 4 and 5) hurricanes, have all increased since the early 1980s.

Sea Level
Sea levels along the Mid-Atlantic and parts of the Gulf Coast have risen by about 8 inches over the last half century.

Figure 1: Major U.S. national and regional climate trends. Shaded areas are the U.S. regions defined in the 2014 NCA.\textsuperscript{2, 4}
CLIMATE CHANGE AND HUMAN HEALTH

CLIMATE DRIVERS
- Increased temperatures
- Precipitation extremes
- Extreme weather events
- Sea level rise

ENVIRONMENTAL & INSTITUTIONAL CONTEXT
- Land-use change
- Ecosystem change
- Infrastructure condition
- Geography
- Agricultural production & livestock use

EXPOSURE PATHWAYS
- Extreme heat
- Poor air quality
- Reduced food & water quality
- Changes in infectious agents
- Population displacement

SOCIAL & BEHAVIORAL CONTEXT
- Age & gender
- Race & ethnicity
- Poverty
- Housing & infrastructure
- Education
- Discrimination
- Access to care & community health infrastructure
- Preexisting health conditions

HEALTH OUTCOMES
- Heat-related illness
- Cardiopulmonary illness
- Food-, water-, & vector-borne disease
- Mental health consequences & stress

U.S. Global Change Research Program
Impact of Climate Change on Health and Productivity of workers

• Impact of climate on the health and productivity of workers in the US
  – Has not been an area of high concern

• The effects of a changing, including rising temperatures, reduced air quality, and extreme weather patterns impact
  – Health of workers directly and indirectly
**Occupational and Environmental Medicine Providers**

- Occupational health care providers and the American College of Occupational and Environmental Medicine (ACOEM)
  - uniquely suited to promote protection of the health of US working populations facing these challenges.

- *Occupational and Environmental Medicine provider’s skill set:*
  - Comprehensive knowledge of the workplace setting
  - Effective guidance to employers in matters involving environmental health-related issues
Guidance Paper from ACOEM
“Responsibilities of the Occupational and Environmental Medicine Provider in the Treatment and Prevention of Climate Change-Related Health Problems”

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Climate Change Impact: Flooded neighborhoods

Repeat Floods
Houston’s Meyerland neighborhood has been hit by three major floods in the past three years, after years of relatively minor flooding.

Rain as measured at a gauge on the Brays Bayou in Meyerland

Source: Harris County Flood Control District
Heat and Ultraviolet Effects

- In 2013, the US Bureau of Labor Statistics
  - Thousands of occupational heat-related illnesses occur each year and more than 350 civilian worker deaths happened in the past decade due to environmental heat exposure
  - Increases the risk of death from common conditions
    - Cardiovascular disease
    - Chronic lung disease
- Outdoor trades workers, athletes, firefighters, military, migrant farm workers. Older, isolated or poorer workers more at risk for heat stress-related illness; workers without access to air conditioning.
Factors Affecting Risk of Heat-related Illness

- Heat-related Illness
  - High temp. & humidity
  - Direct sun exposure
  - Indoor radiant heat sources
  - Limited air movement
  - Not enough fluids
  - PPE & clothing
  - Physical exertion
  - Physical condition & health problems
  - Medication
  - Pregnancy
  - Lack of recent exposure
  - Advanced age
  - Previous heat-related illness
  - Physical condition & health problems
  - Medication
  - Pregnancy
  - Lack of recent exposure
  - Advanced age
  - Previous heat-related illness

Heat-related Illness
Individual outdoor heat-related fatalities 2008-2014 on projection of number of days above 90 °F in 2020

Schulte et al 2016
Heat and Ultraviolet Effects
Heat and Ultraviolet Effects

- Increasing ambient temperatures and heat waves, the OEM provider responsibility includes:
  - Heat stress medical surveillance programs
  - Prevention/adaptation strategies for occupational heat stress
  - To evaluate and treat heat-related illnesses.
Air Quality

• Air quality for working populations is degraded by many drivers of atmospheric change

  – Heat waves
  – Increased global temperatures
  – Potential recurring increases in UV radiation
  – Extreme weather
Air Quality

- The main categories of air pollutants that have occupational implications
  - Ground-level ozone
  - Polycyclic aromatic hydrocarbons
  - Pesticides
  - Allergens

- OEM provider must be able to identify and manage health effects associated with air quality
  - Understand when it is appropriate to obtain Environmental monitoring to measure airborne toxins associated with climate change
Air Quality

• The OEM provider should be able to -
  – Identify, diagnose, and treat occupational or environmental diseases that result from air pollution
  – Manage work restrictions and accommodations
  – Identify and manage health effects associated with air quality
  – Understand when it is appropriate to obtain environmental monitoring to measure airborne toxins associated with climate change
Disaster Zone Exposures

- The trained and experienced OEM physician is qualified

  To prepare employers and workers for disaster-zone exposures related to extreme weather changes, flooding, heat waves, and wildfires by developing protocols for mitigation of a disaster incident at the worksite or in the community in general.
Unstable chemicals
Allergic Sensitization

• Intensification of seasonal variations and extreme weather patterns contribute to allergen exposure.

• Contributing factors
  – Increased temperature,
  – Carbon dioxide
  – Ozone

Ragweed season length, production, and amount of major ragweed allergens have increased in response to elevated ambient levels of carbon dioxide.
A Houston Housing Authority residence for older adults, where the water rose nearly five feet.

Julie Turkewitz/The New York Times
Stress and Mental Health Related Impacts

- The mental health of workers in susceptible occupations can be significantly affected by increasing weather fluctuations associated with changes in climate.
- A positive association has been found between suicide rates among farmers and the severity of drought conditions.
Stress and Mental Health Related Impacts
Stress and Mental Health Related Impacts

Important to guide employers to have additional mental health resources available for their workforce during increasingly frequent severe weather events

OEM provider will be able to rapidly deploy these services for the employees
US Border Patrol agents evacuate residents from a neighborhood flooded by rising waters. Photograph: Zuma/Rex/shutterstock
Waterborne and Vector-borne Diseases

- Climate associated shifts in seasonal and geographic patterns are expected to increase the frequency of certain tick-, mosquito-, and flea-borne diseases

- Outdoor workers are particularly vulnerable to these climate-related health effects
Harvey devastation: the flood-swollen Burnet Bay along the Houston Ship Channel in Texas. Photograph: Tom Fox/AP
Waterborne and Vector-borne Diseases
**Waterborne and Vector-borne Diseases**

- Vector-borne and non-vector-borne diseases create
  - Unhealthy and less physically capable workforce
  - Contribute to decreased local work productivity with associated economic consequences
  - Potential for lingering health effects after resolution of acute illness.
Waterborne and Vector-borne Diseases

- OEM providers should be able to
  - Anticipate and recognize how shifting patterns of vector and waterborne disease might affect worker populations
  - Familiar with prevention, evaluation, treatment, and referral for such conditions
  - Able to notify appropriate public health agencies.
  - Has core competencies specific to the recognition and management of vector-borne and waterborne disease
**Waterborne and Vector-borne Diseases**

Local public health OEM professionals are also trained to develop and implement vector-borne disease surveillance, prevention, and control programs.

- These activities may entail collaboration with other clinical specialties and public health professionals.
Donations for flood victims were distributed on the indoor tennis courts at the Jewish Community Center in Meyerland. PHOTO: ANNIE MULLIGAN FOR THE WALL STREET JOURNAL
Operational Responsibilities

Guidance to the employers

- Extreme temperatures
- Worsening air quality
- Ozone
- Particulate matter
- High pollen count

Devise an action plan with the employer

- Flooding events
- Disruption of essential infrastructure
10 p.m. Sunday

Emergency calls for Help
Senior Airman Adam Secore, a pararescue team member based at Moody Air Force Base, handed off bottled water at a military staging area in Beaumont, Tex. on Thursday.

Christopher Lee for The New York Times
Operational Responsibilities

Effective guidance to employers

Seasonal activity /vector-borne
- Diseases in the working population

Employee Health
- foodborne illnesses

Mental illness due to
- Disasters
- Loss
- Migration
Communication strategies related to -

Climate change related scenarios

Exposure pathways
- Extreme heat
- Poor air quality,
- Reduce food and water quantity

Changes in infectious agents

Population displacement