Climate Change
Addressing Vulnerability through Primary Care

Wynne Armand, M.D. (she/her/hers)
Associate Director, Mass General Center for the Environment and Health
Assistant Professor, Harvard Medical School

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Pillar One
Deliver health care in an environment-friendly way and serve as a model for others.

Pillar Two
Create new knowledge about the inextricable links between the environment and health as well as how to deliver health care sustainably.

Pillar Three
Engage and educate employees, patients and families on the connections between the environment and health and how to work and live sustainably.

Pillar Four
 Advocate for a healthy environment for everyone, particularly those who have been disproportionately and unjustly harmed by pollution.
1. Discuss how climate change affects health.

2. Discuss how to identify patients at increased risk of environmental exposures (heat, air pollution).

3. Give examples of interventions in primary care to reduce these risks and increase patient resiliency.
“The greatest threat to global public health is the continued failure of world leaders to keep the global temperature rise below 1.5°C and to restore nature.”
Climate science
Global atmospheric carbon dioxide compared to annual emissions (1751-2022)

atmospheric CO₂ (parts per million)

year

CO₂ emissions (Gigatons)

Data: NOAA, ETHZ, Our World in Data
Climate science

Yearly global surface temperature and atmospheric carbon dioxide (1850-2022)

- Difference from average (°C)
- Warmer than average
- Cooler than average
- 20th-century average
- Global atmospheric carbon dioxide (ppm)
- NOAA Climate.gov
Fossil fuel combustion

- Greenhouse gases
  - CO2, CH4, N2O
- PM (2.5, 10), NOx, CO
  - SO2, mercury, ozone

Climate change

Air pollution

Morbidity and mortality

PM2.5 from fossil fuel combustion ->
~9 million premature deaths/yr globally
Health impacts of heat
Heat-related illness

**Severe**
- Heat stroke
  - Elevated core temperature
  - CNS dysfunction

**Moderate**
- Heat exhaustion
  - Weakness, nausea, HA; no AMS
  - Water or salt depletion
  - Mild temp elevation
- Heat syncope
  - Brief loss of consciousness from vasodilation
- Heat edema
  - Swelling of limbs from vasodilation
- Heat cramps
  - Muscle spasms, often excess loss of salt
- Heat rash
  - Blocked sweat glands, inflammation of skin

**Mild**
- Heat rash
  - Blocked sweat glands, inflammation of skin

**Mechanism**
- Ischemia
- Heat cytotoxicity
- Inflammatory response
- DIC
- Rhabdomyolysis

**Organ damage**
- Brain
- Heart
- Intestines
- Kidneys
- Lungs
- Pancreas

**Disparities in heat mortality**
- True heat mortality underdocumented
Health impacts of air pollution

- Study of Medicare data from 68 million
  - 2000-2016 death rates rose by 6-8% per 10 mcg/m$^3$ PM$_{2.5}$
  - Excess deaths occurred even at 2.8 mcg/m$^3$ PM$_{2.5}$ (well below EPA standards)
Health impacts of air pollution

Blacks, Asians, Hispanics, Latinos, low-income populations are exposed to higher levels of PM$_{2.5}$ than other groups.
Health impacts of air pollution

**PRENATAL**
- Preterm birth
- Low birth weight
- Infant mortality
- Harm to brain development

**CHILDREN**
- Development of asthma
- More asthma attacks, coughs, and wheezing
- Reduced lung function
- Harm to brain development
- Increased risk for heart and lung disease later in life

**ADULTS**
- Stroke
- Lung cancer
- Diabetes
- Worsened asthma
- Heart disease and heart attacks
- Premature death

**ELDERLY**
- "Adults" impacts
- Dementia and cognitive decline
- Greater decline in lung function
- Heart failure

**RECORD WILDFIRE SMOKE POLLUTION**
Smoke PM2.5 (µg/m3) exposure per person in U.S.

**U.S. smoke exposure increased 27x over last decade**
Health impacts of co-exposure: heat and air pollution

Case-crossover study 2014-2019 in CA, **mortality increase:**

- **Extreme temp** days - 6.1% [4.1–8.1]
- **Extreme PM$_{2.5}$** days - 5.0% [3.0–8.0]
- **Extreme temp + PM$_{2.5}$** days - 21.0% [6.6–37.3]
  - Cardiovascular mortality - 29.9% [95% CI, 3.3–63.3]
  - Respiratory mortality - 38.0% [−12.5 to 117.7]
Climate change
Identifying risk
Identifying risk
Vulnerability

Sensitivity → Impact → Vulnerability
Exposure → Adaptive Capacity → Vulnerability
**Medical factors**

**Sensitivity to heat**

**Comorbid conditions:**

- CKD
- Asthma/COPD
- CVD
- Diabetes
- Neurologic disease (e.g., MS)
- Mental health disorders
- Alcohol/drug use
- (Pregnancy, age)
Medical factors
Sensitivity to heat

Medications:
• Antipsychotics
  • Chlorpromazine, clozapine, olanzapine, quetiapine
• Hypnotics
• Antidepressants
  • SSRI, SNRI, TCA
• Diuretics
• Anticholinergics
• Other cardiovascular meds
  • ACEIs, ARBs, beta blockers

*No trials to guide decision-making re: medications
Environmental and occupational history
Exposure to heat (pollution)

Note **home location:**

- Near refinery/factory
- Near major highways
- Not near green spaces
- Urban
Environmental and occupational history
Exposure to heat (pollution)

Note **job features:**
- Indoor or outdoor
- Dust/inhalant exposures

**Outdoor** examples:
- Firefighters/emergency responders
- Athletes
- Military
- Construction/landscapers
- Agricultural workers

**Indoor** examples:
- Kitchen
- Construction
- Remote worker without A/C
Environmental and occupational history
Adaptive capacity

Note home living arrangement:

• Floor level
• Ventilation and affordable A/C
• Accessibility
• Live alone or have caregivers/dependents
Environmental and occupational history

1. “Do you have a way to stay cool on hot days, and warm on cold days?”

2. “What is your current (and longest-held) work, either in or out of the home?”
The built environment

- Redlining
- Low tree canopy
- Urban heat islands
- Indoor and outdoor air pollution

Chelsea demographics

- 67% Latina/o/x, 79% POC
- 70% speak non-English at home
- 18% (42% Latinx) below poverty level pre-pandemic (v. 11% MA)
- 45% Medicaid (v. 15% MA)
- 7% no insurance (v. 3% MA)
Case example: Chelsea’s built environment

**Historically redlined community**
- 2.2 sq. miles, 16,000 residents/mi²
- 10% crowded housing (v. 2% MA)
- Substandard housing with high flood risk, poor ventilation

**Multiple industrial factories**
- New England Produce Center
- Kayem meat-packing headquarters
- 4 petroleum co., 7 major oil storage terminals
- Waterfront salt piles

**Car, ship, plane emissions**
- Tobin Bridge (85K vehicles/day)
- Flight path for Logan
- Ports

**Redlining**

**Low tree canopy**

**Urban heat islands**

**Indoor and outdoor air pollution**
Case example: Chelsea’s built environment

Benefits of tree canopy:
- Improved mental health and school performance
- Lower crime
- Improved air quality
- Decreased urban heat islands, soil erosion

- 3% of Chelsea land is parks/recreation (national median 15%).
- 750 Chelsea residents per acre recreational open space (American Planning Association recommends 100 residents per acre).
Case example: Chelsea’s built environment

- Redlining
- Low tree canopy
- Urban heat islands
- Indoor and outdoor air pollution
Case example: Chelsea’s built environment

- Redlining
- Low tree canopy
- Urban heat islands
- Indoor and outdoor air pollution

No federal or state air quality monitors until in Chelsea until 2020
Climate change
Reducing risks, increasing resilience
Interventions to reduce impact

Heat

Decrease sensitivity
- Manage comorbidities
- Counsel medications

Decrease exposure
- Check forecast
- Limit outdoor activities, especially 11am-3pm
- Lightweight clothing
- Keep indoor temperatures <80°F (A/C, fan), or
- Move to cool location (until excessive heat warning expires)
- Avoid cooking with heat
- Cover windows from sun
Interventions to improve adaptive capacity

Heat

Improve adaptive capacity

• Advise thermostat
• Ensure cooling mechanisms are in place
• Confirm alternatives for shelter (family, friends, or public spaces)
• Counsel on cooling centers, public water facilities
• Ensure support systems
• Ensure accessible transportation
Interventions to decrease vulnerability
Indoor air pollution

Decrease exposure and sensitivity
• Avoid smoking or fireplace use
• Electrification (benefits to health immediate)

Improve adaptive capacity
• Use vents with cooking, fires
• Use air purifiers (HEPA filter) or A/C
Interventions to decrease vulnerability
Outdoor air pollution

Decrease exposure and sensitivity
• Modify activities based on AQI

Improve adaptive capacity
• Respirator (NIOSH-approved: N95 or P100)
## Interventions

### Education

<table>
<thead>
<tr>
<th>Providers</th>
<th>Patients</th>
<th>Administrators</th>
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</thead>
<tbody>
<tr>
<td>Heat</td>
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<tr>
<td>Wildfires</td>
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<td>Hurricanes</td>
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<td>Floods</td>
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<tr>
<td>General Guidance</td>
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</table>
Adaptive Capacity Resources

- Warning systems
- Cooling centers
- Utility fees
- A/C
- N95 respirator
- Air purifier
- Housing inspections
- Medicolegal partnerships
- Electrification

OSHA-NIOSH Heat Safety Tool for workers and supervisors:
https://www.osha.gov/heat/heat-app

- Download for iPhone or Android
- English and Spanish
- Calculates heat index
- Displays risk level
- Reminders on protective measures
Adaptive Capacity Resources

- **Warning systems**
- Cooling centers
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EPA AirNow mobile app:
https://www.airnow.gov/airnow-mobile-app/

- Download for iPhone or Android
- English (not in Spanish, see PCOI)
Adaptive Capacity Resources

- Warning systems
- **Cooling centers**
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**PLACES TO STAY COOL**

- **Boston Centers for Youth & Families (BCYF) cooling centers**
  BCYF community centers become cooling centers during periods of extreme heat.

- **Pools and Tot Sprays map**
  View a map of places to cool down in the City of Boston.

- **State-owned pools**
  The Massachusetts Department of Conservation and Recreation owns and operates pools and spray decks in and around Boston.
Adaptive Capacity Resources

- Warning systems
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- **LiHEAP** (Low-Income Home Energy Assistance Program)
  - Federal funds for households with:
    - High home energy burden (% income that goes to energy bills)
      - < 60% income state area median
      - Same eligibility to prevent heat shut off
    - Members who are elderly, disabled, or young children
  - Residents who qualify for LiHEAP also qualify for weatherization, energy assessment, and minor energy-related home repairs
  - May not be year-round, eg Nov-April for heat; not cooling
  - Federal program requires SSN (any household member)
  - Undocumented residents encouraged to apply (donor funds)
**Adaptive Capacity Resources**

- Warning systems
- Cooling centers
- Utility fees
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- Electrification

<table>
<thead>
<tr>
<th>• HHS OCCH (Protecting Vulnerable Patient Populations from Climate Hazards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Need SSN</td>
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<tr>
<td>• Medicaid’s Flexible Services Program</td>
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<tr>
<td>• Includes home modifications</td>
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<tr>
<td>• Requires risk of homelessness or nutritional deficiency</td>
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<tr>
<td>• Elder Services</td>
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<tr>
<td>• E.g., &gt;60 y.o. or younger with disability</td>
</tr>
<tr>
<td>• Case by case for in-house privately raised funds</td>
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</tbody>
</table>
Adaptive Capacity Resources

- Warning systems
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- Utility fees
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- Air purifier
- Housing inspections
- Medicolegal partnerships
- Electrification

- City housing inspection services
  - Enforce building, health, sanitation, safety regulations
  - Barriers include:
    - Lack of cooling requirements in codes (vs heating, ventilation)
    - Unofficial living agreements
- Medicolegal partnerships (MLP)
  - Allies healthcare providers with lawyers to address basic needs (housing, food, education, healthcare, stability)
  - National Center for MLP
Adaptive Capacity Resources

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- Air purifier
- Housing inspections
- Medicolegal partnerships
- Electrification

- Local retrofit programs; Rebates and incentives
  - Healthy and Green Retrofit Pilot Program (Boston)
    - Lottery for building owners of 2–4-unit homes
    - $50,000 forgivable loans to electrify/decarbonize
    - Energy assessment, advisor, management/oversight construction
  - Large Building Green Energy Retrofits Program (Boston)
    - Large, aging, affordable housing developments
    - $10 million funding ARPA, $50,000 per unit
  - Mass Save incentives
    - MA homeowner/renter: electrification, weatherization
  - Green and Resilient Retrofit Program (IRA, Dept of Housing and Urban Development or HUD)
    - Improving Energy Efficiency or Water Efficiency or Climate Resilience of Affordable Housing
    - $837 million in grants, $4 billion in loans for owners of properties: multifamily Section 8, Low-income Elderly, Low-income Persons with Disabilities
  - Non-profit community organizations; Education and toolkits
    - Clean Water Action
    - Climate and clean energy campaign
    - Weatherization and high-efficiency heating/cooling for renters, landlords, low- and moderate-income households, language-isolated households, and small businesses
    - Rewiring America
    - Mothers Out Front
Adaptive Capacity Resources

- Warning systems
- Cooling centers
- Utility fees
- A/C
- N95 respirator
- Air purifier
- Housing inspections
- Medicolegal partnerships
- Electrification

- Collaborative team approach
  - Community Health Workers
  - APPs
  - Mobile vans
  - Community organizations
- Trainee curricular programs
- IRA funds
Climate change
Advocacy
A word about advocacy
Using your trusted voice

### Americans’ Ratings of Honesty and Ethics of Professions

Please tell me how you would rate the honesty and ethical standards of people in these different fields — very high, high, average, low or very low?

<table>
<thead>
<tr>
<th>Profession</th>
<th>% Very high</th>
<th>% High</th>
<th>% Average</th>
<th>% Low</th>
<th>% Very low</th>
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<td>Pharmacists</td>
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<td>Judges</td>
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<td>Accountants</td>
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<td>Labor union leaders</td>
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Those with no opinion are not shown.

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### Perspective

Reducing Health Care’s Climate Impact — Mission Critical or Extra Credit?

Alexander S. Rabin, M.D., and Elizabeth G. Pensky, M.D.

August 17, 2023


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### Commentary

**Enough Is Enough. It’s Time To Shut Down The Weymouth Compressor**

June 04, 2021

By: Darcey Fiedler and Philip Landigan

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A word about advocacy
Find your people